THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1612.] LONDON, APRIL 3, 1894. [46TH YEAR. PRICE 6d.

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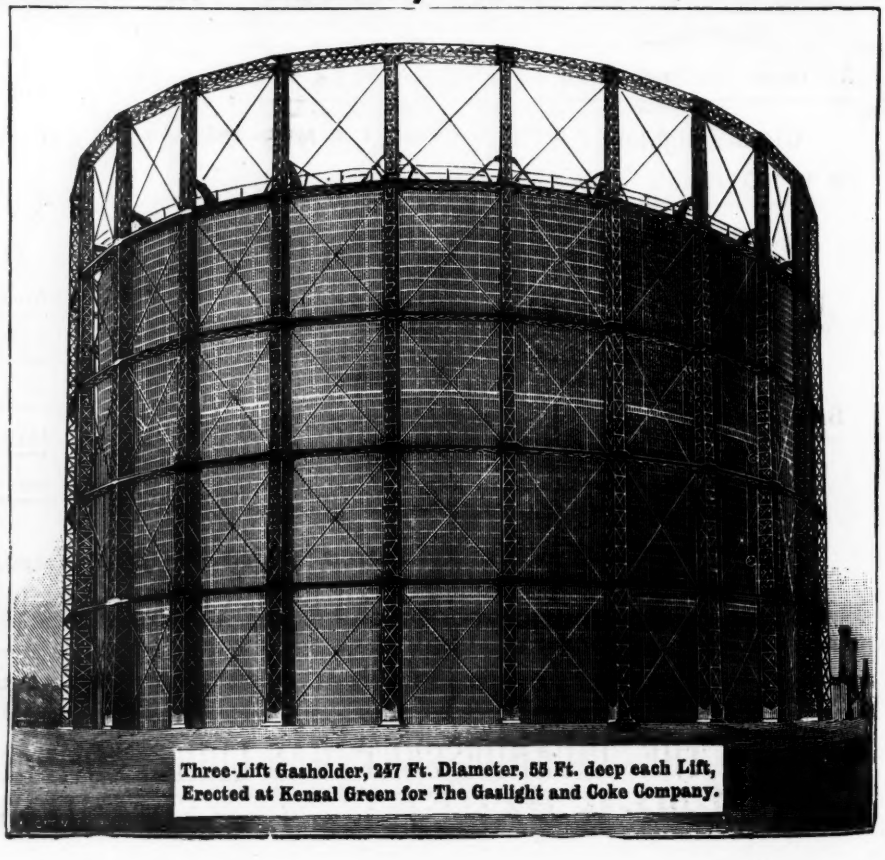

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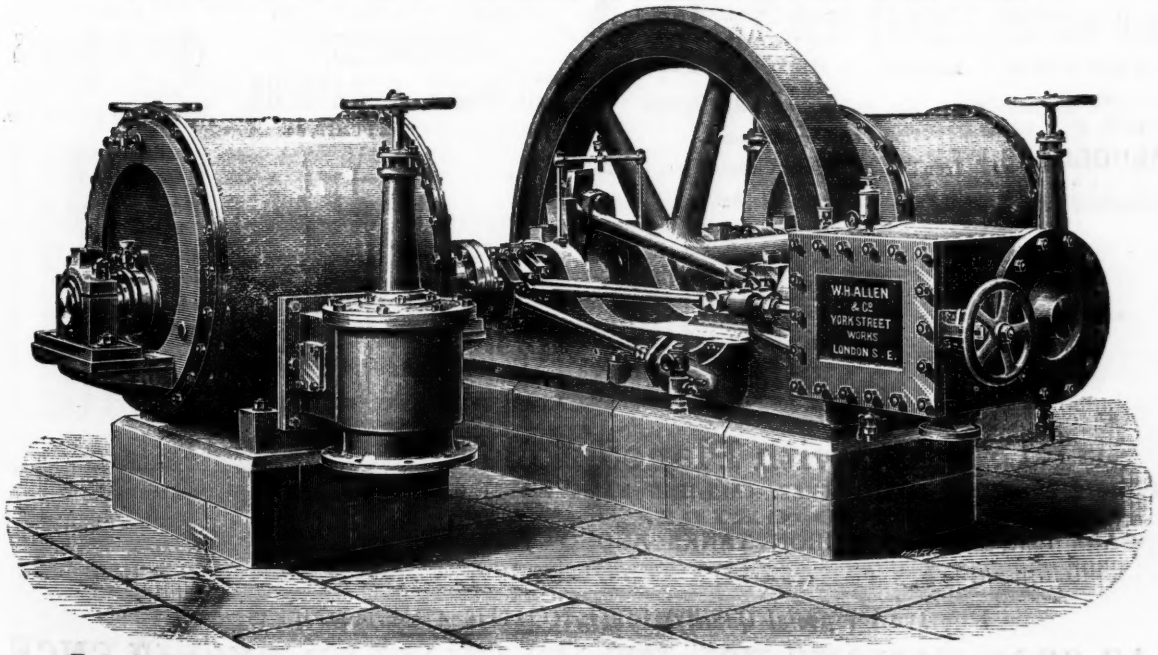

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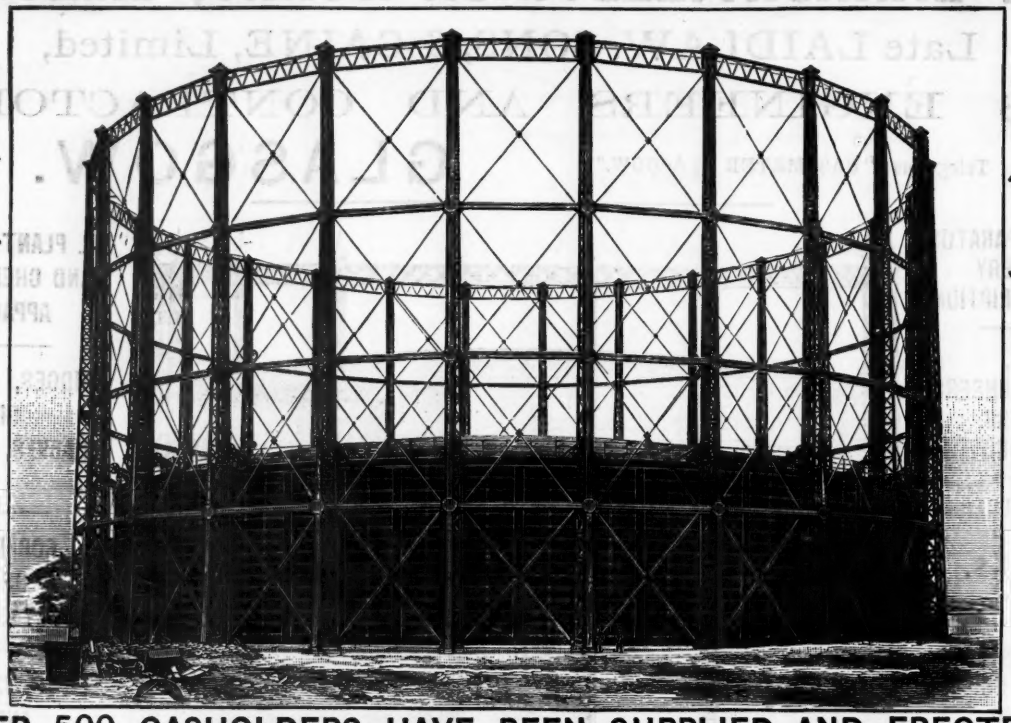

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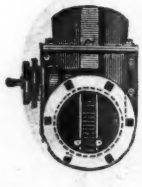

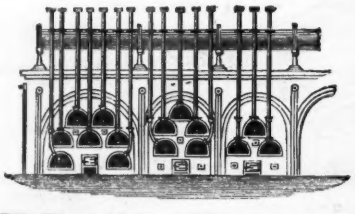

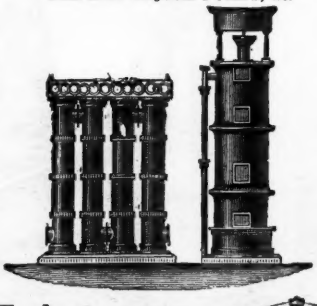

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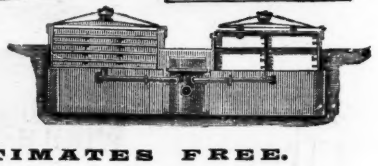

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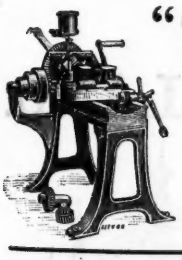

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TELEGRAPHIC ADDRESS: "COWLEY, HYDE." TELEGRAPH CODE: "A B C, 4TH EDITION."

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The Highest Award for Gas-Retorts and other Goods in Fire-Clay has been awarded to KING BROTHERS for their Goods made from their renowned Stourbridge Fire-Clay.

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Manufacturers of
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STOURBRIDGE, ENGLAND.
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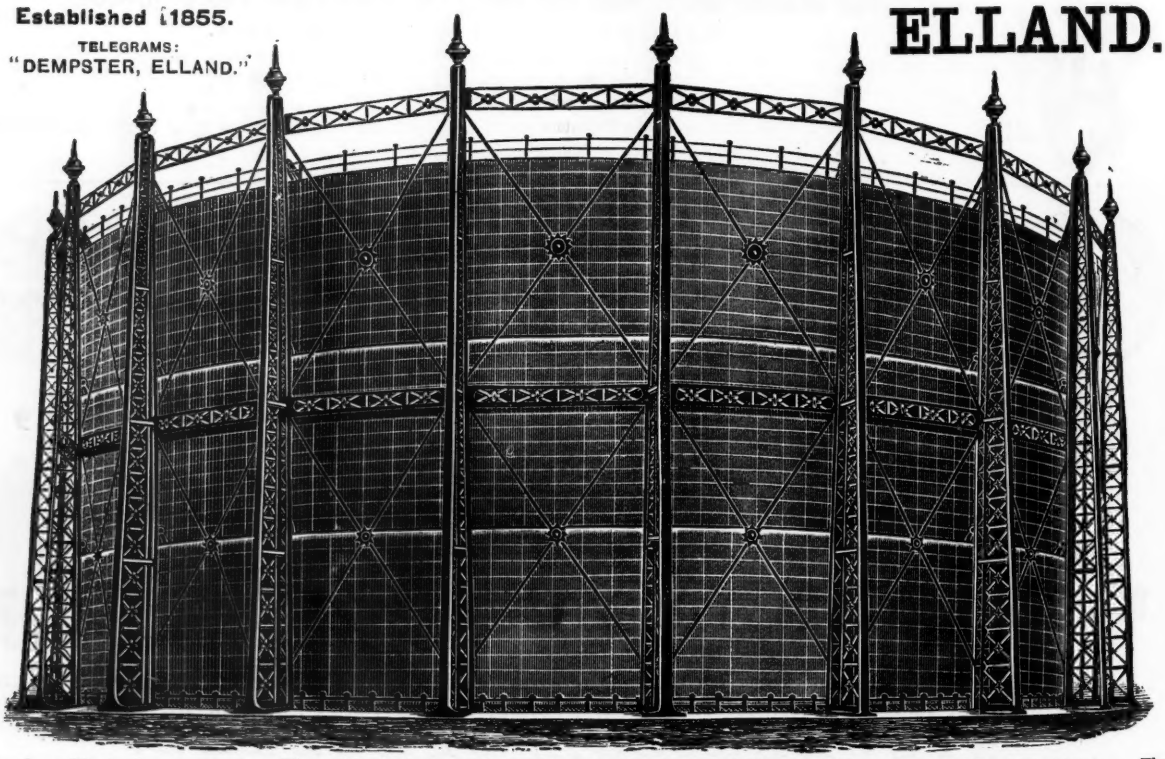

The above Illustration represents a Three-Lift Gasholder, 200 feet diameter, the Cups and Dips of which are made of Bent Steel Plates. The Tripods are of Steel, and braced together by substantial Wind Ties. The whole of the most improved and modern construction.

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"STANDARD" WASHER-SCRUBBERS

These Washer-Scrubbers have recently been IMPROVED by alterations having been made in the form of the Washing Devices, by means of which a great increase in the wetted surface is obtained, with corresponding increased efficiency of the Machines.

OLD PATTERN MACHINES CAN BE FITTED WITH THE NEW PATTERN SEGMENTS AT A LOW COST.

Estimates furnished of the cost of altering old Machines or the supply of new Machines with latest improvements.

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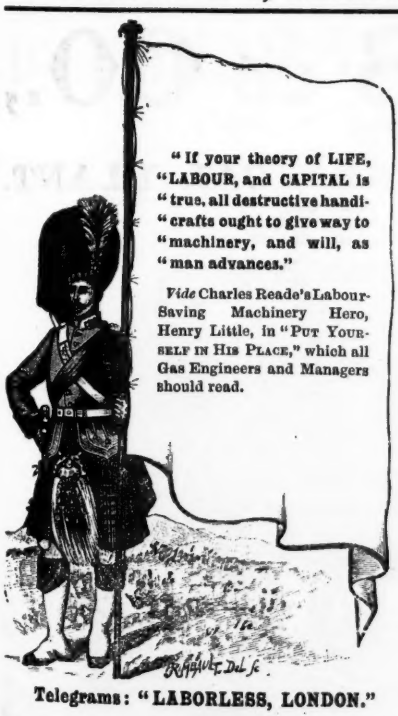

"If your theory of LIFE, "LABOUR, and CAPITAL is "true, all destructive handi- "crafts ought to give way to "machinery, and will, as "man advances."

Vide Charles Reade's Labour-Saving Machinery Hero, Henry Little, in "PUT YOURSELF IN HIS PLACE," which all Gas Engineers and Managers should read.

Telegrams: "LABORLESS, LONDON."

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Automatic Retort-Houses.	
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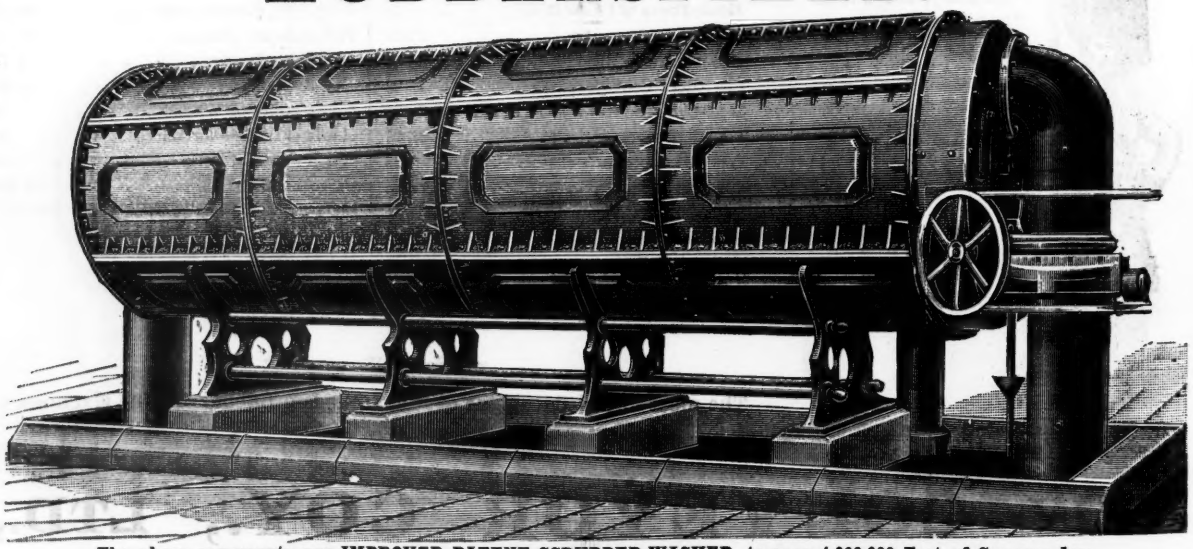

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These Washers are guaranteed to present a larger area of Wetted Surface (size for size) to the action of the Gas than those of any other Maker.

Results unapproached by any other system. *References and full particulars on application.*

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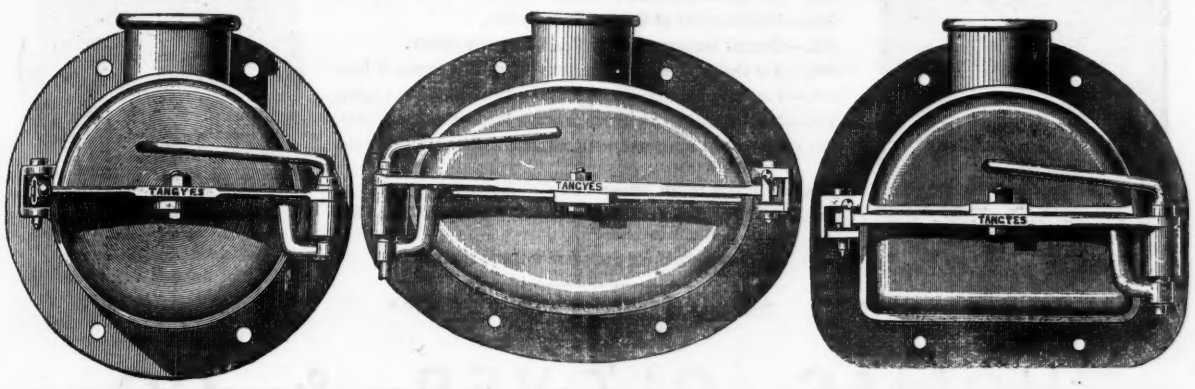
MORTON'S SELF-SEALING RETORT-LID,

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



These Retort Lids and Fastenings are made in three forms, round, oval, and ⌂ (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these Lids are recommended to make their selection, in order to avoid cost of pattern-making, delays, &c., &c.

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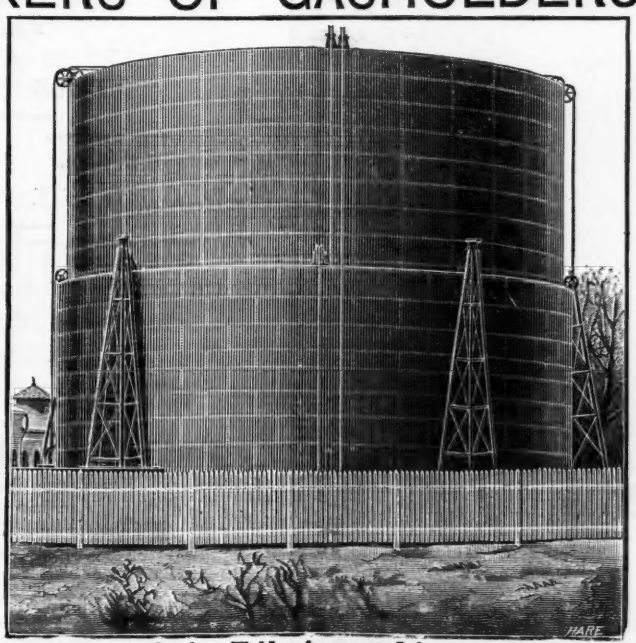

WIRE ROPE SYSTEM

This Engraving is taken from a Photograph of a Holder **increased in capacity from 32,000 cubic feet to 59,000 cubic feet** by the addition of a Lift. The Ropes are applied to both Lifts to supplement the Standards.

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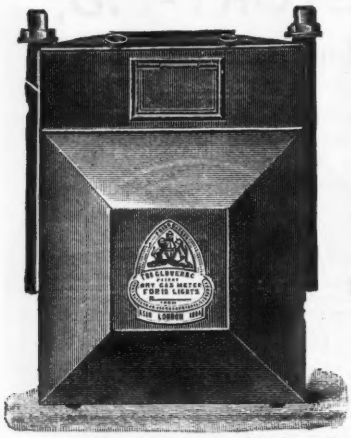
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
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3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

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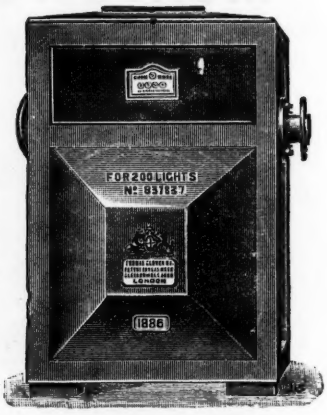

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Telephone No. 6725.

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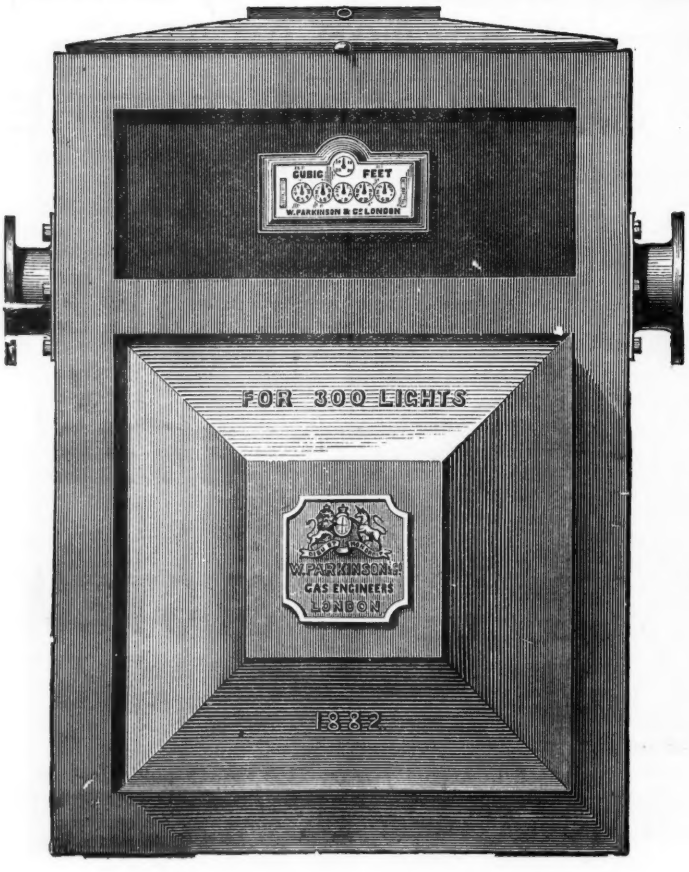

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OF THE VERY BEST QUALITY.

The DIAPHRAGMS are of the Finest PERSIAN SHEEP SKINS.

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Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** Telegraphic Address: "GAS-METERS."

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 3, 1894.

Industrial Economy in South Wales.

An instructive struggle, painfully interesting in some of its aspects, appears to be going on in South Wales for the mastery by the colliers' leaders of good, reliable working principles of industrial and commercial economy. Mr. W. Abraham, M.P.—"Mabon"—and his colleagues who have been instrumental in setting up the sliding scale in this region, whereby coal workers' wages are automatically regulated by the market price of coal, are sadly exercised by the persistent downward tendency of the latter. We have had before us a series of extracts from the *South Wales Daily News*, commencing with the issue for the 22nd ult., the perusal of which has confirmed and intensified our old conviction that sound, popular economic teaching is one of the crying needs of the times. It is pitiful to see men like "Mabon" and Daronwy Isaac, who are the accepted shepherds of the helpless flock of South Wales miners, knocking their heads against hard facts, and so getting stunned and bewildered in their painful search after some means of protecting the local trade from getting into an unprofitable way. These worthy men cling to the sliding scale, which has for so long kept the industrial peace in the district; but they feel their hold slipping from it by reason of the impossibility of upholding the selling price of coal by any such arrangement. They see that, if coal prices continue to fall, there will come a time, if the hour has not even now struck, when the sliding scale will be discredited. They feel that wages are not safe in the custody of prices; and they would fain reverse the operation, and see a sufficient wage made a condition precedent of, instead of a dependent on, coal sales. This is precisely what the leaders of the Miners' Federation are committed to effecting by posing their "living wage" standard as that for which alone their men will work. Rather than jeopardize this standard, it is understood that the Federation Executive are willing to restrict the working time to three days per week; their avowed object being to prevent the colliery proprietors from having any such accumulation of stocks as would induce them to undersell one another. "Mabon," too, would check the output of coal in his own district, if he could, by shortening the period of daily labour; but his difficulty is that the men themselves will not agree to curtail their present earnings.

This bit of contemporary fact, attested to and bitterly complained of by Daronwy Isaac in a speech made to the miners at Ynysybwl, is a lurid comment on the notion possessed by some Members of Parliament that work in mines can be limited by legislation to eight hours a day. Meanwhile, "Mabon" accuses the Welsh coalowners of not doing their best to maintain prices, in consequence of which the wages rate is going down. He declares that there is not enough demand for the coal now being produced in South Wales, and that therefore the owners are laid open to the machinations of contract brokers, or middlemen, who go about from office to office beating down prices. He thinks the owners might resist this practice if they chose. But here he stands at fault; for just as he fancies he has a clue to the way in which prices might be beneficially controlled, or at least protected, it fails him. He admits in one place that "we are not of "the people who hold the notion that coalowners can, if "they please, retain the price of coal at any height;" and elsewhere he goes on to distinguish the underselling to middlemen from the effect of "inevitable and world-"wide competition," by referring to the former as the "inner circle" and the latter as the "outer circle" of influences affecting the value of coal. But how is any such distinction to be detected, much less acted upon, in practice? Does "Mabon" think that, if he were at the elbow of any particular coalowner, he could help the sorely-pressed man to know when to stand firm and when to yield a point rather than allow a big contract to pass away to another district? There is only one bargaining; and it is impossible to draw the line between fair and unfair higgling, as "Mabon," who is not without some economical insight, attempts to do. Moreover, it is idle to suggest that, if immediate self-interest and life-long experience cannot teach coalowners how to get the best price for their product, this end can be furthered by any adjurations in the interest of the miners.

The position of the Federation men is clear; and whether or not one is prepared to applaud it, there is no mistaking it. This position simply is that the colliery proprietor is not to have his coal brought to bank under a certain minimum rate of wages. He may agree to sell coal at any price he pleases to accept for it; but the miner will have his "living wage." It is impossible to help sympathizing with this attitude on the part of the men, and not difficult to frame a wish that it may prove tenable. It must be admitted, however, that the odds against it are very heavy. For nobody can sell coal except to willing purchasers; and the question of whether coal is to be bought here or there is often determined by a very small preferential consideration. The Federation plan of maintaining prices by working short time and so restricting the output is, after all, a suicidal proceeding; for it imposes an unrelenting pressure upon prospective buyers to seek supplies from places where the rule does not apply It is as though a farmer should aim at raising the market value of wheat by refraining from cropping half the area of arable land at his command. No man can hope to establish a "corner" in any commodity without power to

control all the sources of production. A weighty pronouncement upon this side of the question is made by a writer in the *South Wales Daily News* of the 28th ult., in answer to the theorizing of "Mabon" and others, which ought to have been read as a "lesson" in every church and chapel throughout the mining districts the following Sunday. The writer points out that a "living wage" cannot be expressed definitely in terms of currency. It must be a relative term, governed by the value of the necessaries of life, which in turn are subject to the vicissitudes of the market. The miner objects to what he calls the "cut-throat competition" of coalowners, in trying to sell their output for what it will fetch. But who benefits more than the miner by the "cut-throat competition," which ceaselessly operates in bringing down the prices of the articles he buys with his wages? The miner thinks it right and convenient to restrict the production of coal; but he would not like the producers of bacon and flour to take a leaf out of his book. Suppose, however, the policy of restricting the output of coal were to be in force everywhere, by virtue of a strong agreement between masters and men in this trade, and that the effect was a marked enhancement of the price of this commodity. What would be the result? Every industry depending upon an ample and cheap fuel supply would suffer. The prices of commodities would rise, people would take less of them, less fuel would be required, more men would be thrown out of work, the trade of the country would be ruined, and coal mining would simply go to the dogs with it. This is the sort of teaching that working men as well as their leaders need. But where is a sufficiency of it to be had? The newspapers drivel politics or platitudes; the preachers drone about historical dogmas; the professors of political economy keep snug within their studies, out of the way of the people who do not read their books; and the men who actually rule the actions of the multitude rant away shamelessly about the sinfulness of Gas Companies and other wealthy monopolists in purchasing coal at the lowest market figure. Meanwhile the magnificent national capital we possess in our coal-fields is being spent to the running accompaniment of strikes, lock-outs, squabblings, and revilings.

The Report and Accounts of the Commercial Gas Company.

THE report and accounts of the Commercial Gas Company for the half year ended Dec. 31 last will be found in another column; and the general meeting will be held on Thursday. The report states that the revenue account shows a net profit for the half year of £59,132, making with £627 received for interest a total income of £59,759, which is increased to £62,754 by adding the amount carried forward from the previous half year. After deducting the interest on debenture stock, there remains a balance of £59,041 available for distribution, out of which the Directors recommend the payment of dividends after the rates of 12½ per cent. per annum on the old stock, and of 9½ per cent. per annum on the new stock. For the corresponding half of 1892, the net profit on revenue account was £44,441; so that the position of the Company has greatly strengthened since then—partly, of course, by reason of the price of gas having been increased from 2s. 6d. to 2s. 9d. per 1000 cubic feet. The capital expenditure now stands at £861,094, and of the additional outlay £1129 is stated to be for "new coin meters and "fixing"—a fresh entry in these accounts deserving of passing notice. The revenue account shows that the sale of gas brought in £135,940, against £138,672 for the corresponding period of the previous year; while residuals returned £53,018, compared with £39,160—the greatest improvement being in the coke. On the other side, coal dropped from £74,711 to £64,470; and carbonizing wages are reduced from £19,251 to £17,890. Repairs and maintenance have gone up from £14,904 to £19,388. Salaries and wages of officers in the distribution department are £736 less; but considerably more has been spent upon repairs and renewals, bringing up the total cost of distribution from £6264 to £9575. Bad debts are slightly higher. The total expenditure on revenue account was £132,881, as compared with £136,522; so that the bulk of the improved balance comes from the other side. The quantity of gas sold shows a falling off of just over 5 per cent. There has been a praiseworthy attempt, attended with a considerable degree of success, in the direction of cutting down the quantity of gas consumed on the works; and the proportion of unaccounted-for gas is also smaller. The most remarkable piece of economy to be detected in the works accounts, however, is in the amount of coke used as fuel, which shows a considerable drop. Does this mean the adoption, after all, of generative furnaces; or what other explanation can be found for this result? Whatever may be the cause, we must congratulate Mr. H. E. Jones, the Engineer and General Manager, upon the effect. He has evidently been "putting his shoulder "to the wheel," and getting his assistants to do likewise, under the pressure of the tightness of business which has lately overtaken the Company. Thus the uses of adversity—if such a strong term is applicable in this case—are seen once more to be not without their compensations.

Gas Workers' Strike in Vienna.

IT sounds quite like old times to hear of the stokers employed at all the gas-works of a great city turning out in a body, which occurrence was the "sensation" of Vienna on Thursday last. We in England have passed through this particular kind of industrial disease, which hurt nobody much beyond the foolish men who fell victims to the mingled influences of credulity and self-conceit, and so threw up a comfortable livelihood at the bidding generally of demagogues who had nothing at stake. The Viennese outbreak seems to have been largely of political origin, seeing that a Social Democratic Congress was in progress in the city at the time, the members of which, on receiving intelligence of the action of the strikers, forthwith proceeded to pass a resolution warmly approving of their decision. This is just what was to have been expected; but we have not learnt that the Social Democrats did anything more solid for their stoking friends, who have thrown up the safe employment at good wages which they had in the service of the Imperial Continental Gas Association in a fit of passion for which they are probably sorry enough now. Vienna is no place for workmen who quarrel with their bread and butter. Beautiful and gay as the Austrian capital proverbially is—and for anybody with money to spend and a heart to spend it there is no jollier city upon the planet—Vienna is a stony-hearted stepmother indeed to the poor who live in the working quarters. The gas-works are among the very few really prosperous industrial undertakings of this ancient city, which wears a bright mask over much fretting misery; and nobody who has the smallest acquaintance with the reputation of the Association's local Chief Engineer will believe that the trouble with the men was due to any harshness upon his part. We have not full particulars of the affair to hand as yet; but we are confident that, when the tale is told, the Association will be found blameless.

Legalized Conciliation in Industrial Disputes.

LAST Thursday, Mr. Mundella, the President of the Board of Trade, obtained leave to bring in a Bill to make better provision for the settlement of labour disputes. In substance the measure is to be the same as the proposal which was before Parliament last session; but it is not quite identical with that untimely fruit of the Administration. Last year's Bill did not confer any power of initiative upon the Board of Trade; but it is now proposed to give this power, to a certain extent. According to the revised version, wherever a trade difference is found to exist, the Board of Trade are to be authorized to invite the parties to meet together by themselves under the presidency of a chairman mutually agreed upon, with a view to the amicable composure of the dispute. This is exactly what took place in connection with the settlement of the coal strike last autumn. The next clause of the Bill gives power to appoint a Conciliator or a Board of Conciliation; and under this the Board of Trade may set up a Board of Conciliation in a district, to deal with a particular dispute. Provision is further made for the appointment of an Arbitrator; and, in mentioning the compilation of what he called the "roll of honour" of arbitrators, Mr. Mundella took the opportunity of referring to the admirable services rendered in this line by Mr. David Dale, Sir Rupert Kettle, and Sir Henry James. Under the provisions of the Bill, the Board of Trade may appoint a person or persons to inquire into the condition of a trade dispute, and confer with both employers and employed, with a view to aiding and assisting and bringing into existence Boards of Conciliation. Practically,

the object of the measure may be summed up as that of calling, as far as possible, Boards of Conciliation into existence, and assisting their organization by enforcing such rules, regulations, and methods as have proved successful in the past, and recording and publishing useful decisions. When, as the President of the Board of Trade remarked, one comes to consider the vast mischief accruing to this country from labour disputes, and when it is also remembered how often these have no real justification, it will be agreed that everything Parliament can do to reduce the evil should be done. Unfortunately, the Bill of the Government is open to the reproach that it aims at effecting very little. Sir John Lubbock has in hand a project of legislation of the same character, under which the award of an Arbitrator or a Board of Conciliation would be made binding upon the parties. Without this power, it is difficult to see how some cases would ever be settled. In many instances—perhaps in most—the pressure of public opinion would suffice to make the parties to an arbitration in matters of this kind abide by the result. But it would not always be so; and a single failure to make its award fully respected would be most damaging to any Board of Conciliation. If the Government and Sir John Lubbock can between them hit upon some means of cutting the ground from under the feet of the professional agitator, who promotes strikes "for a "principle," or for "sympathy," or just to exhibit his ascendency over his dupes, the industry of the country will be indebted to them for a great boon.

Dangerous Lamps and Oils.

A SAD fatality, due to a lamp accident, occupied the attention of Dr. Danford Thomas and a Clerkenwell jury on the 28th ult. A married couple and their three children lost their lives in a fire which occurred in Northampton Street, Clerkenwell, on Easter Eve, and which originated in the upsetting of a glass lamp by another inmate of the same house, who escaped with slight injury. The matter was taken up by the County Council, who sent an officer to assist the Coroner and his jury in arriving at a satisfactory verdict. It was stated that the County Council wished to make use of the incident in support of a legislative movement for the suppression of dangerous lamps, which in the course of a single year are responsible for more deaths in every capital in Europe than all the Anarchists' bombs that were ever made. It is indeed high time that action was taken in this regard; but it is to be hoped that the County Council and the Government will not muddle the matter by confining their repressive action to the lamps, when in reality the oil is as much, or even more, to blame. In this particular instance, the lamp was of a very common pattern, of opaque glass, reservoir and stem in one, and necessarily fragile and top-heavy. Evidence was given on behalf of the County Council to the effect that lamps should be made of metal, in accordance with the recommendations of Redwood and Abel. This is all very well with oil of a safe flash-point; but it is notorious that the cheap American petroleum admitted into England with a flash-point as low as 75° Fahr. cannot be safely burnt in a lamp made wholly of metal. Indeed, in the early days of what were then known as "camphine" lamps, either glass or earthenware receptacles were insisted upon, on account of their being poor conductors of heat, and so preventing the liquid from being raised to a dangerous temperature by the heat of its own combustion. The friends of the Scotch shale oil industry have long been agitating for the raising of the flash-point of lamp oils in this country from the present dangerous figure to something at least above that ever reached by the air of a closed apartment in summer; and probably a flash-point of 100° Fahr. is quite low enough for perfect safety with metal lamps. It might possibly be said that the more accidents that happen with poor oil and cheap lamps, the better for the gas industry; but we have no desire to base the recommendation of gas upon any such sad comparison. Let the poor be protected, by all means, from the risk at present attaching to the petroleum lamps which are otherwise so deservedly popular with householders of a certain class, and in the country are simply indispensable. Good lamps and safe oil may not be the best friends of the gas industry; but bad lamps and oil giving off inflammable vapour at ordinary summer temperatures are foes to the human race, and should be stamped out of existence.

WATER AND SANITARY AFFAIRS.

THE next few days are likely to prove momentous in the history of the Metropolitan Water Supply. It rests with Parliament to decree either that the quantity of water requisite for the increasing population of London and its suburbs shall begin to fail, or that due provision shall be made to meet the wants of the immediate future. The Bills of the East London and the West Middlesex Companies are set down for their second reading next Thursday, to be followed probably on Monday by the Bill of the Southwark and Vauxhall Company. Should these measures undergo rejection, after the manner of the East London Bill last year, the result to a large portion of the Metropolis can be little less than disastrous. There is no question as to the necessity which exists. General Scott several years ago pointed out the growing peril; and the pressure is beginning to be distinctly felt. The East London Company have now a stronger case than before; the Royal Commissioners having recorded an opinion that the Company are taking more water from the Lea than their present storeage justifies. Further works are therefore imperative. The Southwark and Vauxhall Company state that, to give the present population of their district a daily supply of 35 gallons per head, as specified by the Royal Commission, they must obtain a daily volume of 30,000,000 gallons on an average, subject to an occasional maximum of 34,000,000 gallons. General Scott reports the daily supply furnished by this Company last January as exceeding 29,653,000 gallons; and therefore not falling far short of the 30,000,000 gallons. The desperate nature of the situation is shown by the circumstance that the Company are only authorized to take from the Thames a daily supply of 24,500,000 gallons. Even if we add to this the 3,000,000 gallons which Mr. Restler, the Company's Engineer, reckons on getting by pumping from the gravel beds, the total is considerably less than the quantity now consumed; and it will fall still more behind as the population becomes augmented by the 9000 a year or more which is the present rate of increase, equal to an additional demand of about a million gallons per day in three years. We have on a previous occasion referred to the distinct terms in which Mr. Binnie, the Engineer to the County Council, has recognized the critical circumstances which now beset the London Water Supply. He is clearly of opinion that something must be done at once to enlarge the supply from the existing sources, only he would prefer for the Council to step in and do it. Merely to oppose the Bills of the Water Companies is, in the opinion of Mr. Binnie, to court defeat. Yet we find Mr. James Stuart, M.P., a prominent member of the Council, telling a political meeting formed from among his constituents at Hoxton, that he intends to move the rejection of the three Bills of the Water Companies; his action being "on behalf of the "County Council, in order that the question might be "properly considered." Where could the Bills be more properly considered than in a committee-room of the House of Commons? But that is the kind of consideration which Mr. Stuart is resolved, if possible, to prevent. He also seeks to obtain the rejection of the Thames Conservancy Bill; but, if failing in so great an enterprise, he will propose an instruction to the Committee which, if acted upon, will reduce the powers of abstraction by the Thames Companies to the extent of 20,000,000 gallons per day. Such is the respect paid to the Royal Commission; and such is the regard shown for the urgent need which besets the Metropolis.

The letter addressed to *The Times* by Mr. Walter Hunter, to which we briefly adverted last week, showed that the estimated cost of 10 millions, or rather less, for the Staines scheme of water supply, was only made up by capitalizing the pumping charges, leaving £5,391,000 as the total cost of the works. Compared with this, we have 30 millions as the cost of bringing an equal quantity of water from Wales. A reply to Mr. Hunter's letter appeared in *The Times* on the following day, from the pen of Mr. Bassett Hopkins, the Chairman of the Water Committee of the County Council, who contends that the capitalized pumping charges should be included as part of the estimate. Still it should be understood that all is not immediate capital expenditure. But Mr. Hopkins carries the matter a step farther, and cites Mr. Binnie as an authority for the statement that, including filtering

areas, the prevention of pollution, and other items, the probable expense of the Staines scheme would not be much less than 20 millions. If this would be the cost of taking a supply from a source within a few miles of the suburbs, what is likely to be the expense of bringing water from Wales? Concerning the abundance to be obtained in the Thames Valley, Mr. Hopkins persists in his statement that the schemes propounded would enable the Companies "to take from the Thames the whole of "the water running down to Teddington, with the excep- "tion of 200 million gallons per day." Let us compare this with the report of the Royal Commissioners, where it is shown that the average daily flow of the Thames at Teddington Weir is about 1350 million gallons. According to Mr. Hopkins, the Companies would be in a position to appropriate more than 1000 million gallons per day, or enough, at 35 gallons per head, to furnish a daily allowance for all England, *minus* Wales. The truth is, as stated by Mr. Hunter, that the Staines scheme of storeage is based upon the requirement of the Thames Conservancy that the minimum dry-weather flow of the Thames at Teddington shall never fall below 200 million gallons per day. The same result is provided for in the Southwark and Vauxhall Bill. Mr. Hopkins ridicules the idea that this would improve the flow of the river, apparently oblivious of the fact that for some few days in 1887 the minimum flow was as little as 154 million gallons per day —a shrinkage which would never occur again if either the Staines scheme or that of the Southwark and Vauxhall Company were adopted. The question is one of storeage; and this is provided for in both cases. Yet Mr. Hopkins so far misunderstands the matter as to assert that by either of these schemes "the flow *all the* "*year round* would be reduced nearly to the minimum dry- "weather flow in extreme cases of long drought." Mr. Hopkins suggests that Mr. Hunter, in the views which he has advanced on this subject, "must have largely "discounted the intelligence" of his readers. Mr. Hunter seems far more justified in his complaint that a majority of the County Council "appear to subordinate "administrative efficiency to political partisanship, and "will not even take the trouble to grasp the rudimentary "knowledge necessary to enable them to form a sound "judgment upon the question at issue." The facts are clearly on the side of Mr. Hunter.

Society of Arts.—Last night, Captain W. de W. Abney, C.B., F.R.S., gave at the Society of Arts the first of a course of three Cantor Lectures on "Photometry." It was devoted to a consideration of the different sources of light and its qualities. Next Monday, he will deal with the measurement of light; and on the 16th inst., he will discuss the applications of photometry to various scientific purposes. At the ordinary meeting of the Society to be held on the 11th inst., Professor Vivian B. Lewes is announced to read a paper on the subject of "London Coal Gas and its Enrichment."

Two Large American Gasholders.—Our American contemporaries are notorious for their skill in the production of attractive headlines to articles; but the *New York Herald* a short time ago, in its efforts in this direction, departed slightly from actual facts. The new gasholder which is now being completed for the Consolidated Gas Company, close to the foot of West Sixty-fifth Street, was said to be the "largest in the world," although the writer of the description said "there is but one other in the United States that even approaches it in size, and it is in Chicago." The *American Gaslight Journal* promptly corrected the *Herald* writer by referring to the East Greenwich and other large gasholders in this country. With regard to America, the Chicago holder is certainly larger than the New York example, as will be seen from the following dimensions: Chicago holder: Tank, 190 ft. diameter by 43 ft. 6 in. deep; inner lift, 179 ft. 6 in. by 42 ft. 9 in.; second lift, 182 ft. by 42 ft. 3 in.; third lift, 184 ft. 6 in. by 41 ft. 9 in.; outer lift, 188 ft. by 41 ft. 3 in.; working capacity, 4,289,500 cubic feet. New York Holder: Tank, 187 ft. diameter by 43 ft. 6 in. deep; inner lift, 177 ft. 9 in. by 42 ft. 4 in.; second lift, 180 ft. by 41 ft. 10 in.; third lift, 182 ft. 3 in. by 41 ft. 4 in.; outer lift, 184 ft. 6 in. by 40 ft. 10½ in.; working capacity, 4,106,000 cubic feet. "While it is true," says the *American Journal*, "that both holders, considering the magnitude of the scale of their construction, approach each other closely in dimensions, it is also nevertheless true the difference in their actual capacity (183,500 cubic feet) represents a storeage provision that exceeds the storeage provided by at least 40 per cent. of the separate gas companies of the country. In other words, 40 per cent. of the gas companies of the United States and Canada would have sufficient storeage capacity for their daily needs, were they the possessors of a holder calculated to retain 183,500 cubic feet of gas.'

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 624.)

THE reopening of the Stock Exchange on Tuesday after the Easter holiday was marked by a degree of joyousness almost approaching enthusiasm. The long-deferred revival of business, with the advent of the public on the scene as real buyers, seemed to have come at last. The weather was splendid, and traffics were brisk. "Baring Bonds" were working off, and grand progress was made when the Bank placed a million Uruguays. Americans moved up, notwithstanding a momentary check when it was feared that the President's veto on the Seigniorage Bill might lead to a struggle. The Kaffir market was very busy; and thus everything was bright all round. A slight reaction in the course of the week supervened; but all was well again by the close. If nothing sinister should unexpectedly occur, prices are likely to keep rising; for there must be an immense amount of money wanting investment. In the market, money was in strong demand for the settlement, after which it toned down easier. The Gas Market has not been particularly active, owing perhaps in some degree to scarcity of stock; but it is very firm. The public are realizing more and more clearly the true value of really sound Gas Undertakings—indeed, it is astonishing that they have been neglected so long; and it is almost incredible that stocks which are eagerly snapped up now should have been positively unsaleable some four or five months ago. Of the Metropolitan Companies, Gaslight "A" has been steadily done at moderate figures, but without any disposition to advance. Among the secured issues, the "B" and "H" have improved in price; but there was hardly any business done. South Metropolitans were only moderately active, but very strong; and the "C" and the debenture are higher. No business was marked in Commercials; stock being scarce. The issue of this Company's accounts completes the record for the second half of 1893, and shows that, like the other undertakings in and around London, they have profited by cheaper coal and dearer residuals, and have earned their dividend with a handsome surplus, notwithstanding a diminished gas-rental owing to the abnormal weather. The Suburbans and Provincials also exhibit improvement; Brentford and Crystal Palace having advanced. The Continentals present no feature beyond consistent firmness. Many other foreign undertakings, however, are higher—including Bombay, Buenos Ayres, Melbourne, and Monte Video; while Bahia is the only instance of a loss. The Water Companies are quiet, and mostly unchanged; but the persistent demand for gilt-edged securities has sent Lambeth debentures up to a very high price.

The daily operations were: Gas opened very firm, and remained quiet and unchanged all Tuesday. Wednesday was also inactive; but several quotations rose. South Metropolitan "C" advanced 3; ditto, debenture, 2; Melbourne, 2; Buenos Ayres debenture, ½; and Bombay, ¼. Malta fell ¼. Thursday was still rather inactive, but very firm. Brentford new rose 2; Gaslight "B" and "H," 1½ each; and Buenos Ayres, ¼. In Water, Lambeth debenture gained 3½, *ex* interest. Friday's variations were few and slight—Malta recovering ¼; while Bahia fell ½. Saturday was as active as any day of the week. Crystal Palace improved 3; and Monte Video, ½.

ELECTRIC LIGHTING MEMORANDA.

The Street Lighting of the Strand District—Electricity and Gas for Street Lighting—Pending Electrical Projects—Major Flood Page on the Commercial Progress of Electricity.

THROUGH the courtesy of Mr. Arthur Ventris, Engineer and Surveyor to the Strand District Board of Works, we have received copies of the tender of the Metropolitan Electric Supply Company for lighting a portion of the Strand by means of arc lamps, and of his reports on this scheme and on an alternative plan for the improvement of the gas lighting. The net result of the investigation of the whole matter by Mr. Ventris is to establish the facts that, whereas the improved gas lighting would cost £6408, that of the proposed arc lighting would amount to £11,842 per annum. This is for the whole district. Mr. Ventris's method of treating the subject is very lucid and comprehensive. He recommends his Board to improve the lighting of the thoroughfares in their district by increasing the power of the existing points, or lamps. He shows that the present lighting is inadequate, which is not to be wondered at, seeing, as he remarks, that the points were fixed a very long time ago, when gas was double the price it is now. The district is a very old one, and was probably one of the first parts of London to be really lighted by gas; and the arrangements for this service have never been thoroughly reconsidered with a view to satisfying modern requirements. Improved "refuge" lamps have, indeed, been provided where imperatively called for; and a standard lamp, consuming 15 cubic feet of gas per hour, has been adopted by the Strand Board when dealing with increased lighting. Mr. Ventris proposes that all the public lighting should be levelled up to this standard, which could be effected with the co-operation of The Gaslight and Coke Company, and would be all that is necessary. On the present rateable value of the district, the total

expenditure on gas lighting would still be only 2·64d. in the pound, which would be well within the practice of the majority of Metropolitan highway authorities. Mr. Ventris observes that he is "strongly of opinion, after viewing the public lighting of the town of Chelmsford, that, with gas at 2s. 2d. per 1000 cubic feet, electric light cannot compete with gas as an illuminant in the streets of the Strand District."

An interesting feature of the inquiry into the Strand lighting is the practical agreement of the District Engineer and the Engineer to the Metropolitan Electric Supply Company, who were asked to tender for the service, as to the lack of sufficient reason for supplanting gas by electric lamps. Both admit that the positions of the existing lighting points were originally decided upon for very good reasons, especially with regard to the lighting of street corners, the outlets of narrow passages, and doorways; and that if the numerous points required for these purposes were replaced by the fewer points necessitated by the adoption of arc lamps of the usual pattern, the change would give rise to a great deal of dissatisfaction in the district. Looking at the matter solely as one of candle power, Mr. F. Bailey, the Engineer to the Electric Supply Company, agrees that Mr. Ventris's standard 15-feet gas lamps may be credited with from 40 to 50 candle power; and he admits that, although it is possible to obtain very small arc lamps giving something like this power, he "should hesitate to recommend such a novel departure, in the absence of further experience of this method." Then, falling back upon incandescent lamps as the only electrical alternative, this particularly candid electrician goes on to confess that the advantages, such as they are, which attend the use of this system of lighting indoors do not apply to the case under consideration; so that there is nothing to extenuate the higher cost of electricity as compared with gas. Very possibly also the Metropolitan Electric Supply Company are not anxious to add to their lamp connection a service which is not highly paid for, and which would tend to raise the apex of their already too mountainous load diagram.

The Board of Trade report upon Railway, Canal, Tramway, Gas, &c., Bills and Provisional Orders of the session states that there are 26 Electric Lighting Orders applied for, involving an estimated capital expenditure of £402,970. Last year the number was 18, and the proposed capital outlay £756,350. These figures show that the electricians have fallen upon the days of small jobs. Of all these applications, only 10 are by private persons and companies; and several of these refer to small undertakings already established. The largest scheme is that of the Grimsby Corporation; and for this only £45,000 is required. The Plymouth Corporation contemplate an outlay of but £30,000 for the same object. Evidently there is not much money to be made in this line of business. In these circumstances, the energy of electricians and their supporters on the grand scale naturally shows a tendency to seek other channels of activity; and during the past week the attention of the public has been drawn to electric railway schemes, the most considerable of which is that of the Charing Cross, Euston, and Hampstead Railway Company, who require £1,416,000 of share capital. This undertaking was authorized by an Act of last year, which sanctioned the construction (under the Greathead system) and the working of an underground electric railway about five miles long, connecting Charing Cross with Euston and Hampstead. It is intended to equip the railway for a two-and-a-half minute service each way, with seating capacity for 200 passengers per train; the idea being to run light trains at short intervals. Some good names are connected with the venture, which is just speculative enough to attract a sufficiency of the loose cash that must be burning the pockets of people with a taste for promising investments. The line selected for exploitation is a good one; and the same remark applies to the kindred Waterloo and Mansion House scheme. But while there is an inexhaustible amount of traffic in and about London only waiting to be tapped in order to flow freely along any number of conveniently disposed lines of transit, the problem of bringing down the running expenses so as to leave a satisfactory margin of profit for stockholders is by no means disposed of. Still, the thing may doubtless be done; and, in any case, there will be more hope for electricians in these railway works than remains for them in the lighting branch.

Major S. Flood Page can apparently always obtain a "free advertisement" in the correspondence columns of *The Times*, whenever it suits his purpose to write one of the chatty, ingeniously-worded letters by means of which he is accustomed to enlighten the world with respect to matters electrical. He had his say last week, to the extent of a column and a "turnover," on the "Commercial Progress of Electricity;" being inspired thereto, as he averred, by having been constantly pressed "in society, or when travelling, or in the course of general business," for information on the subject. It is pleasing to hear that such keen and widespread interest in any branch of industry exists on the part of the general public; and Major Flood Page is evidently gratified thereby. But there is another explanation of the cause of such curiosity which is not quite so comforting. It is possible that the people who ply Major Flood Page with the style of query to which he refers, do so by reason of their anxiety to learn how soon the electrical industries in general may be expected to return reasonable dividends to their shareholders, or how long it will be before electric lighting is supplied at the price of equivalent gas. Be this as it may, our "complete letter-writer" attemps to assure the public, through the medium of *The Times*, that there is substantial progress to be reported of many electrical industries. He does this by repeating the story of the introduction of the Jablochkoff "candle" in 1877; and he rounds off his tale by stating that at the present time about £6,500,000 is sunk in central station lighting ventures, some of which actually pay dividends, while all (he hopes) will do so eventually. It is the old song of the "Happy Land," which remains "far, far away." Major Flood Page twits Mr. Corbet Woodall for having stated, so far back as 1879, that, in his opinion, electric light could not compete with gas in houses; but he has the grace to confess that Mr. Woodall only said at the time what any other engineer would have corroborated. Major Flood Page himself did not know much about electric lighting in those days; and even now, although he always writes pleasantly on the subject, he can hardly claim to be able to say anything about it that is not generally known.

MATHER ON THE FORTY-EIGHT HOUR WEEK.

THE most interesting incident of the past week for the industrial order of the community was the issue of the report of Mr. William Mather, M.P., of the Salford Iron-Works, upon the year's experimental working of this important concern under the system of the "Forty-eight Hour Week." This publication received most respectful attention in all the leading newspapers throughout the country, and deservedly so; for, unless we are greatly mistaken, it marks an era in the development of the industrial community of these realms. It is a striking coincidence that, in offering in these columns last week some observations upon the signs of the times as regards the industrial position, we should have, in a sense, anticipated the substance of much of Mr. Mather's statement. Or, putting the matter the other way about, it is gratifying to us to receive so speedy a corroboration of the accuracy of our attitude in regard to the industrial movements of the day. To keep in touch with these movements, and to enable the many regular readers of the JOURNAL who are scattered over the wide world to maintain knowledge of, and sympathy with them, is at once our duty and our pleasure. Last week we endeavoured to sum up in a couple of paragraphs the position and certain of the most obvious results of the 48-hour week. Now we are able to treat the subject more fully in the light shed upon the general question by Mr. Mather's statement.

It must be admitted, to begin with, that the experiment at the Salford Iron-Works started under very favourable conditions. The works in question are large—employing ordinarily about 1200 hands; and the class of trade engaged in by the firm is among the best of its kind. Besides general mechanical engineering work, the firm have several well-known specialties, and are known as progressive, energetic, and successful in business. They do a lot of good work, and get full prices for it. In short, such an establishment is precisely of the right stamp for undertaking an experiment like the one in question. Moreover, the new departure was made during a time of peace, when employers and employed could without prejudice come to an understanding respecting matters affecting the conduct of the common employment. So it was on all counts a happy inspiration that led the heads of the firm, towards the end of 1892, to the conclusion that their establishment was well suited for making trial of the much-discussed 48-hour week. The condition precedent was unreservedly accepted, that the same wages were to be paid as for the 53-hour week prevailing hitherto, and the firm decided that they would make the experiment at their own cost, whatever this might be, for a full period of one year, subject to every possible precaution for enabling the results to be accurately ascertained in every respect.

The next step was to convene a mass meeting of the workpeople in one of the shops, at which the scheme was formally explained and laid before them. The men were told that the firm wanted to devise a plan whereby the hours of labour could be shortened without any reduction of wages. The idea was that it would be better for workmen if they could start their work after enjoying a good solid meal with their families before leaving home; while it was pointed out that, what with recreations, amusements, and night schools, it is "not so easy" for working people to go to bed at nine or ten o'clock now, with a view to turning out at five or half-past in the morning, as it was twenty or thirty years ago. As a result of the meeting, a Committee was formed; and eventually it was arranged that (with the week commencing Feb. 20) the works would, by stopping the two hours previously worked before breakfast, run 48 instead of 53 hours per week at the same rate of wages. At the same time a clear understanding was arrived at with the President and Secretary of the local branch of the Amalgamated Engineers, that during the year over which the trial was to extend no demand should be made upon other employers in the district for a reduction of hours; and that Messrs. Mather and Platt should have the right to modify the scheme without prejudice in the event of its proving a failure. It was explained, in a circular issued to the employees, that without their active co-operation with their employers, to be manifested by their observing greater punctuality and showing increased energy and interest in their work during the shorter hours, it would be

impossible for the whole trade to eventually unite in carrying out the new system. The men, it was added, must be prepared to follow the strictest rules as to starting punctually in the morning and after the dinner hour, and they were reminded that, on the face of it, the new arrangement was bound to entail some considerable sacrifice on the employers. This, however, the firm were prepared to risk, in the hope that the general result would be satisfactory all round. An important feature of the scheme was the abolition of overtime, except for breakdowns and repairs; extra pressure of work being met by the employment of additional men on the double-shift plan. An accountant was told off to take notes of every special detail of time and cost of working during the year, which, as it turned out, was one of general trade depression; thus making the experiment more difficult to carry through.

The statistical results are set out by Mr. Mather in detail, most of which would be out of place here. The wages-cost had to be collated with the amounts of output and turnover, which were affected by external influences. It is declared that "had prices ruled the same, the turnover in the trial year would have been greater, and the wages-cost, instead of showing an increase of 0·4 per cent., would have shown a decided decrease." As it was, this fractional figure represented the actual increase in the ratio of wages-cost to turnover. Next comes the question of the saving of consumables on the one hand, and the greater load of fixed charges on the other. There was found to be "a marked economy in gas and electric light, wear and tear of machinery, engines, gearing, &c., fuel and lubricants, and miscellaneous stores." On the other hand, the increased fixed charges due to interest on plant and machinery, rent and taxes, and permanent staff on fixed salaries, were determined with reference to the diminution of five hours per week in the working time. The balance of debtor and creditor account on these expenses is unmistakeably in favour of the trial year—the basis of comparison being the average of the previous six years. "Thus, by a remarkable coincidence, a saving of 0·4 per cent. is secured as a direct consequence of the shorter hours, which counterbalances the debit of 0·4 per cent. in the increased wages-cost." There was marked improvement in regard to time lost, which fell from 2·46 per cent. on the 53-hour system to 0·46 per cent. under the new arrangement. It is upon the piecework that the changed conditions might be expected to tell most severely. Mr. Mather admits that the natural assumption was at the outset that the piecework men were already doing their best; and hence that, if their period of work were shortened, their earnings would be correspondingly diminished. "This anticipation has not been realized; for, although there is a falling off in the percentage earned by pieceworkers over and above what they would have received as day wages, it is slight in comparison with the reduction in the time, and particularly so in the later portion of the year." There appears to have been a progressive adaptation to the altered conditions; so that it is quite expected that the small difference remaining at the end of the year will soon disappear. It is remarked that in no instance were the piecework prices advanced, while some reductions were made.

Thus it will be seen that Mr. Mather's report is altogether in favour of the new system. It also appears from his statement that it was he who was mainly instrumental in persuading the heads of the Government Departments in which the system has been introduced to make the change. He gave them figures of a more confidential nature than those he is able to make public; and upon them action was taken. So that the political capital which certain members of the present Administration have shown themselves not disinclined to make over the "example" they set by this action to private employers of the country turns out to be based upon nothing more than a readiness to follow the lead of one particular private firm. This has not always been the habit of Government Departments; so that, after all, something must be said to the credit of the heads in this regard.

And now, what is to be said about it all? Far more, we are assured, than can fitly be said here. One point is to be particularly emphasized, however, if the bearings of Messrs. Mather and Platt's experiment are to be properly understood. This Forty-eight Hour Week of theirs, whatever its teaching, has no connection with the Eight-Hour Day of the New Unionists, from which indeed it differs in motive, inception, and method of operation. It is quite possible that Messrs. Tom Mann, Tillett, Burns, and Co., may claim the credit for all that Mr. Mather has done; but it is not the least satisfactory feature of this experiment at the Salford Iron-Works that the party of professional agitators had nothing whatever to do with it. As was pointed out last week in these columns, the ruling motive of those who call themselves "Eight-Hour Day" men is the reduction of the number of the unemployed. But, so far as can be made out, not one single extra man has found employment at the Salford Iron-Works as a result of the new system of working adopted there. What has come to pass is just what we remarked last week. There has been a general smartening-up all round; but this is the last thing the New Unionists desire. Messrs. Mather and Platt carried out their experiment in direct agreement with the Amalgamated Engineers, whose conduct in regard to this business has been most praiseworthy. They will have their reward; for now the pressure upon all employers in the engineering trades, to place their establishments in line with the Salford Iron-Works and the dockyards, will be irresistible. By their statesmanlike co-operation with Messrs. Mather and Platt, the Amalgamated Engineers have hastened by years a great amelioration of the lot of the members of this great Society, and have saved the cost and hazard of a strike. Nobody denies that the shortening of the hours of labour is a good thing; but as *The Times* puts it, "the difficulty in the minds of those who object to off-hand cutting down of the hours of labour, has always lain in the unanswered question whether the industry of the country can afford what no one doubts is a boon." So far as a single experiment can prove anything, this test by the Salford Iron-Works is an answer to the question. Mr. Mather's report points to the conclusion that "the two morning hours before breakfast are not worth the pains and trouble they cost, whether to work-people or to employers." They are merely the relic of bygone ideas, hatched amid circumstances that are no longer existent, more particularly in the case of town workers. "Not only are these two hours before breakfast almost worthless as time, but their effect upon the physical and mental condition of the men is to depreciate the vigour, freshness, and brightness which ought to prevail throughout the working day, if the best results are to be obtained." This is a most momentous conclusion, the effect of which will be felt throughout the whole industrial community. Those firms which act in accordance with it will have the pick of the workmen in their trades, which circumstance will at first tend to give the new system an adventitious recommendation. Men and masters will, however, find their proper level eventually; and there is good reason to believe that the early morning "quarter" will be amply compensated for by the various economies of a system of working which involves only one stoppage during the day. In all occupations there must be a golden mean between overwork and slackness, at which the worker is at his best. Mr. Mather claims to have found this in the engineering trade in the 48-hour week. He does not pretend to dictate to other trades, but shows how the followers of different industries may help themselves without crying for legislative aid. "A rigid law passed by members of an Imperial Legislature, whose votes are often given hap-hazard, or for party reasons, or for a 'safe seat,' can never provide a remedy for such conflicts as those which arise in the industrial world in connection with the complex questions of wages and hours of labour." For this plain declaration of his principles, we fully expect to see Mr. Mather and all his works roundly abused by the New Unionists and their supporters in Parliament and in the Press.

Mr. Walter W. Hutchinson has been appointed Secretary and Manager of the Barnsley Gas Company, in succession to his father, whose death was recorded in the JOURNAL for the 20th ult. We much regret that our congratulations to Mr. Hutchinson on his appointment have to be mingled with condolences for another bereavement he has just sustained in the loss of his mother, who succumbed on the 27th ult. to an attack of acute bronchitis which resulted from a chill taken on the day of her husband's interment.

The Value of Water-Meters.—The value of water-meters in small cities where the supply has to be pumped, is shown very clearly in the report for the past year of Mr. C. A. Ballou, City Engineer of Danville (Va.). In 1891, about 509 million gallons of water, in round figures, were pumped, and 1182 tons of coal burned. No meters were used. Last year only 215,200,000 gallons were pumped, and 553 tons of coal burned—a reduction due to metering all but four of the services. The rates charged were low—only 10c. per 1000 gallons for domestic, and 5c. per 1000 gallons for business purposes. The individual bills for domestic use were from 60 to 75 per cent. less than formerly. One of the greatest benefits secured by the use of meters has been due to the ability of the Water Department to supply only clear water to the city. This is secured, not by pumping muddy water into the reservoir and letting it settle, but by stopping the pumps when the river water is muddy, and drawing the supply entirely from the reservoir, which holds a quantity of water sufficient for quite 12 days, owing to the diminished consumption brought about by the use of meters.

The Charging Arrangements for "Automatic" Retorts.—The objection is at times raised to the use of sloping retorts, that it is possible for stokers to "short-charge" them, by carelessness or otherwise. Mr. Maurice Graham, Assoc.M.Inst.C.E., has recently patented a simple automatic "sure-feed" arrangement, which is said to entirely overcome any such defect. His arrangement is designed to ensure a full charge in the retort every time the lever is pulled, and prevent the slide at the bottom of the measuring chamber being closed when only half a charge has been distributed. This is done by fixing in the chamber, tank, or truck (and immediately above the bottom slide) a weighted hinged flap. The weight of coal in the chamber presses the moveable flap against the slide, and thus prevents the charge falling down the shoot until the bottom slide has been fully opened. The flap is then forced down with the coal; and, being the full width of the opening, this prevents the slide being shut until the whole of the coal has fallen from the tank. The flap is raised automatically by a small weighted lever; the stoker immediately afterwards returning the main lever to its original position.

NOTES.

The Carnot Theory and Gas-Engines.

Writing in the *Engineer* on the application of the Carnot theory to gas and air engines, Dr. Oliver Lodge, F.R.S., remarks that internal combustion engines are fed not with heat, but with chemical energy. Mixed substances may be introduced at any low pressure, and then ignited. The old gunpowder-engine was of this type; and so are guns. Internal combustion motors, however, Dr. Lodge reiterates, are more chemical engines than heat engines. They definitely consume substance, like a furnace, as well as heat like an engine. They have no fixed quantity of working substance to go round and round in a cycle; but they transform chemical energy partly into work and partly into heat. They represent both the furnace and the engine. In comparing their bulk with that of equivalent steam-engines, the bulk of the boiler must be included in the latter, and that of the gas-generator with portable or self-supplying patterns of the former. As Dr. Lodge pertinently observes, "the coal-bunker is common to both." One peculiarity he notes of the gas-engine cycle is that the cylinder must somehow be emptied of the products of combustion before admission of the next charge; hence the diagram of such engines is obviously and notoriously a double-loop cycle. Dr. Lodge gives a typical diagram of an internal combustion engine, showing the pump loop below the engine loop, from which it has to be subtracted to give the resultant work. The most curious of this type of engine is one invented by Joule, wherein the resultant diagram looks like that of an Ericsson engine; but it works with a pump instead of a regenerator. It does not dispense with adiabatics; but it replaces the isothermals by an approach to constant pressure operations.

Glan's Observations of Candle Flames.

Commenting on the observations of Glan (see *ante*, p. 524) upon the relation between the dimensions and the luminosity of a candle-flame, the *Electrician* remarks that Faraday's classical lectures on the candle did not exhaust the subject. Mention is also made of Professor Stokes's pretty experiment of focussing the sun's rays by a lens on the flame of a candle, which shows two bright discs where the cones of light strike the luminous envelope. The light thus concentrated illuminates the solid particles of carbon in these parts of the flame to a much greater brilliancy than that due to their intrinsic lighting power, which is the result of the heat of the flame; and they are thus shown to be capable of reflecting light, and consequently to be solid. The same point was made by Professor Lewes in his Cantor Lectures on the cause of the luminosity of gas-flames. Our contemporary further remarks that the luminous sheath of a candle-flame is very thin; and it is pointed out that Herr Glan has not called attention to the fact that the flame of a candle is of an oval horizontal section, because of the wick. It is stated to be the practice to place the two candles in a photometer with the planes of the wicks at right angles to each other; but it is remarked that the flame is so nearly transparent that this precaution is generally unnecessary. Upon this and other points of the treatment of candles in the photometer, the recorded experiments of Methven and Sugg may be studied with advantage. Our contemporary declares that the mean projected area of the luminous part of the flame of a standard candle is about half a square inch; and its brilliance is therefore two candle-power per square inch.

Lennard on the Cathode Rays.

Some remarkable experiments have been made by Lennard, and are reported at length in *Wiedemann's Annalen*, on cathode rays in the open air—the rays discovered by Hittorf, and studied by Crookes as radiant matter. These rays, although due to the electric discharge, are distributed in a manner which is perfectly independent of it. They are in many respects a phenomenon analogous to light, from which they are yet distinguished in certain essential respects. Unlike light, the cathode rays will penetrate solid bodies, and are stopped by glass. These rays, under conditions detailed by Lennard, have penetrated sheet platinum more than seven times the thickness of the ordinary platinum foil. They make the air glow faintly around the so-called platinum "window" through which they emanate in the Lennard apparatus, while the platinum itself remains dark. Phosphorescent bodies exposed to the cathode rays glow with their characteristic lights, just as when these substances are enclosed in Geissler tubes. All these phosphorescent phenomena are extinguished by bringing a magnet to bear; and the cathode rays produce no sensation whatever when they impinge on the skin, nor do they affect the eye. The atmosphere is a turbid medium for the cathode rays. They are actinic, yet have no heat. They will penetrate into the interior of spaces closed metallically, and are quite separable from the electric forces producing them. Their appearance further complicates the puzzle of the ether.

Mr. G. Sumner, of the Ilford Gas-Works, has been appointed Manager of the Woking District Gas Company, Limited. This situation was advertised in the JOURNAL for Feb. 13 (No. 2340).

TECHNICAL RECORD.

THE CONSTRUCTION OF GASHOLDERS.

At the Meeting of the Society of Engineers held last night, a paper on the above subject was read by Mr. E. LLOYD PEASE, Managing-Director of Messrs. Ashmore, Benson, Pease, and Co., Limited. We give below the principal portions of the communication, which was illustrated by models and diagrams.

The author commenced his paper with the following remarks: Gasholder construction is far from being an exact science. It seems still to be in an experimental stage. There are no standard lines or data to be carefully adhered to, as in the construction of roofs and bridges. These latter are built to suit the purpose for which they are required, with sufficient strength, and without waste of material. Can this be said of the large gasholders of the present day? Judging by the diversity of design displayed, this question must be answered in the negative.

In a search for economy in gasholder construction, the first and largest item that catches the attention is that of exterior support. Its cost is generally from 30 to 50 per cent. of the total expenditure, without contributing a single foot to the storeage capacity of the works. Let us look for a moment at the nature of the support supplied to keep the floating vessel of a gasholder in a level position. When a gasholder was the simple thing it was at the beginning of this century, it mattered little if the few short posts used were much more substantial than necessary. It is now a very different matter in the case of a modern gasholder, containing as many thousands as the former did hundreds of cubic feet. When a vessel of great size, rising to a height of 150 or 200 feet, has to be surrounded with 20 or 30 posts of a similar height, the question as to what constitutes a safe and economical support is one of great importance, and on this point there is much diversity of opinion.

Mr. Pease went on to say that marked contrasts in design are frequently met with in holders of about the same size; and, in support of this statement, he cited three examples of three-lift holders. In the first, which was 150 feet in diameter and each lift 30 feet deep, the weight of the columns was 553 tons, and that of the girders 159 tons—total, 712 tons. In the second, which was of the same diameter, but each lift 6 inches deeper, the weight of the columns was 198 tons, and that of the girders 66 tons—total, 264 tons. In the third, which was exactly the same size as the first, the weight of the wrought-iron standards and girders was 128 tons only. This contrast, he said, force upon the mind the observation that, if the last-mentioned design is safe, the former designs are wasteful. For want of evidence to the contrary, it must be taken that the light lattice standards are strong enough. From the fact that very light standards are seen to successfully do the work required of them round a large gasholder, the question arises whether the higher portions of them are of any value at all, or are ever called upon to bear an appreciable strain; and also whether the inflated cylinder of iron that they enclose, held rigidly by the lower portions of the standards, and incapable of the slightest bending or vibration, is not infinitely stiffer than the higher portions of the standards, and in reality (from its own inherent strength) as immovable as a rock, when the lower portions of the standards are of sufficient strength.

There are other details, however, that have some importance. Many large holders that have worked with great regularity for a long period have crown carriages of the very simplest design, and, in comparison with some modern carriages, of the very lightest description. There is a fashion in these things; and at the risk of hazarding a suggestion that may be questioned, it would almost appear that the use of tangential and radial rollers in carriages on the upper lifts has spread from their use in the large holders of the South Metropolitan Company. If they are necessary, or their use is justified, on such exceptionally large holders, which in themselves struck out into a new line, can they be considered to be necessary in holders not half the size, when past experience has abundantly shown that very simple, and almost fragile, carriages are sufficient? If they are not necessary, their use is a mistake, seeing that they are, in proportion to their weight, by far the most costly part of a gasholder. The use of tangential rollers on the outer lift, when one or more lifts rise above the columns, is quite another matter, since the question of leverage of the wind presents itself.

These two points—the massiveness of the exterior supports and the construction of the carriages that bear upon them, with the number and strength of the vertical stays in the holder body (and perhaps there ought to be added the weight of the top curb)—are all points in which there is great divergence in practice. There is no finality in the existing information on these points. It is just possible that some surprising facts would come to light, if a careful investigation were carried out as to what is proved to be actually sufficient in various existing holders in the four points just referred to. The collection of designs thus formed, if selected in parts and placed together to form one holder, might lead to a standard design—light, simple, and cheap. This paper, however, attempts to approach the question of how far the construction of a holder can be cheapened and simplified from other considerations.

Mr. Pease then proceeded to consider the use of columns; his remarks being as follows: It goes almost without saying that the usual custom of providing columns to the full height of the holder is founded on the belief that the holder, when fully inflated, is not in itself sufficiently strong to resist the force of the wind. Possibly this has to some extent been led up to by the fact that holders have invariably been contained in excavated tanks and counterbalanced, in which case columns have to be provided to support the counterbalance. If it had not been so, and iron tanks on the surface had been used, it would very early have been found that the supporting arrangement of three ropes connected to one weight, even if the ropes were attached to the bottom curb, supplied all the support required, and that the holder itself was abundantly strong and stiff without assistance from any columns. If, then, the problem of gasholder building had developed from the premises that small holders were sufficiently strong, instead of from premises that columns, while carrying the balance-weights, were also necessary for the support of the holder, there would not now be the very strong prejudice in favour of columns the full height of the holder that is so widely spread. Seeing that the largest gasholder ever constructed has two lifts without external guide-framing, and many smaller holders have been built without columns of any description, the fact that guide-framing is, to some extent, superfluous has been demonstrated without doubt. But this fact is not generally acknowledged and acted up to so as to have become trite and uninteresting.

In the opinion commonly prevailing, the function of columns divides itself into two—that of preventing distortion and of preventing overturning. If they are not necessary for the former case, they need only be built to meet the second demand upon them—that is to say, if a gasholder will keep its form, columns are only required to such a height as would prevent overturning. There are three factors that lend weight to the theory that the gasholder requires little, if any, exterior support. In the first place, the weight of the sides suspended from the top curb places the side sheeting in tension; and this is at its maximum at the top, and runs out to nothing at the bottom curb. At the bottom of the second lift—in a three-lift gasholder, for example—it exists to the extent induced by the weight of the outer lift. In the scond place, gasholders are by no means structurally devoid of power to resist the pressure of the wind; for it must be remembered that they are more than able, as far as each of their lifts is concerned, to bear their own weight without distortion, as is shown by the fact of their standing on the tank resting-stones before inflation. This structural strength may certainly be estimated as being in reserve; for, when inflated and suspended in a normal condition, their powers in this direction are quite untaxed. In the third place, inflation itself creates considerable additional stability in the holder.

In considering the question of the ability of the free lifts, or lift, of a telescopic holder to withstand wind pressure without distortion, the strength imparted by all three factors before mentioned has to be estimated. In a case in which exterior support is discarded altogether, the tension in the sides induced by the hanging weight ceases to be a valuable factor, seeing that it practically does not exist where the light sheeting begins just above the bottom curb, and which is presumably where buckling would first of all show itself, because (if the expression may be allowed) it is not in this position pulling at anything, and therefore is not taut.

In the following remarks, an attempt is made to estimate the ability of a three-lift gasholder, 180 feet in diameter and each lift 30 feet deep, to resist the wind pressure when (1) supplied with outside support to the height of one lift, and (2) without any exterior support. The wind pressure of a 40-lb. per square foot gale against the windward surface of the two upper lifts may be taken to be $(180 \times 60 \times 40) \div 2 =$ (say) 97 tons. The question of parallelism of the gasholder need not come into question here; it is presumably secured by the weight and strength of that portion of the holder within the columns working of necessity with a horizontal movement. Whether other means besides the use of ordinary rollers and carriages can be with advantage adopted will be referred to later in this paper. The outer lift of a 180-feet holder may be taken to weigh about 90 tons. This is supported by the inner and second lifts. The lower part of the second lift (that just rising above the columns) is in vertical tension to the extent of 90 tons—that is, to the amount of the weight of the outer lift hanging upon it. The outer lift is essentially horizontal. Owing to its position within the columns, and its weight being distributed round the entire circle of the inner lift, there is obviously a strong tendency for the sides to maintain a vertical position, and for the crown of the holder to be horizontal and parallel with the outer lift.

One of the models before you represents a three-lift holder, 180 feet in diameter and each lift 30 feet deep. The two inner lifts are constructed of silk only, without any vertical stiffeners; and the outer lift is made of tin, of such a weight as to give approximately the same water pressure as the outer lift of such a holder—viz., 2½ inches. Any stiffness displayed by the two inner lifts is entirely due to the fact that they form the connecting link between the horizontal hanging weight of the outer lift and the vertical support of the gas. The holder can only be bent or distorted about the bottom part of its second lift by a force sufficient to overcome the vertical tendency of the gas, and bend it about the same point—the lower third of the gas being unaffected. There is an elasticity and springiness in a column of gas confined under these conditions, when the lower portion is contained in a heavy and horizontal vessel, sufficient to transform by inflation the most flimsy material into a substantial structure. It may be argued, therefore, that there is considerable stability given to the free lifts of a holder by the column of gas they contain. Being vertical in itself, and held, as it were, as to a third of its height, in a vertical position, it supports the vessel by which it is confined.

It is now necessary to consider the strength that the shell of a holder may possess as an iron structure, in forming an estimate of the ability of the lifts rising above the guide-framing to resist the force of the wind. It has been mentioned that the sides of a holder, while at rest, and standing upon the rest-stones in the tank, do not exhibit any signs of distortion in that portion of the sides that joins on to the strong plates of the cup, and that supports approximately the whole of the crushing weight of the sides. It is evident from this that the sides of the holder have at least this amount of structural strength—a strength that is not drawn upon when the holder is inflated and hanging suspended, in contradistinction to standing on the rest-stones.

The second lift of the holder taken as an example weighs about 80 tons. As the ability to withstand a crushing force equal to this weight still exists when the holder is inflated, it must be considered when estimating the ability of the holder to offer resistance to the distorting power of the wind. Although this second lift is a structure capable of sustaining a weight of 80 tons, the actual conditions under which it exists in normal circumstances are such that, in place of being subjected to compression, it is really in tension to about the same amount, owing to its own suspension and the weight of the outer holder (90 tons) hanging upon it. The lowest portion of the light sheeting of the second lift, consisting of $\frac{3}{16}$-inch sheets, may be considered to be the first point at which buckling or crumpling would make its appearance. This, however, cannot take place until the vertical tension of 90 tons, and the latent strength of the sides of 80 tons—equal to 170 tons—have been overcome.

Mr. Pease then proceeded to refer in detail to his diagrams; his remarks being as follows: The wind pressure of a 40-lb. per square foot gale on the inner and second lifts is taken to be 48 tons and 49 tons respectively. That of the inner lift is taken to be applied at the dip of the second lift, owing to the holder being a jointed structure. The two forces combined produce at the distance shown of 91 ft. 6 in. an induced strain of 24 tons, acting downwards. Against this 24 tons is to be placed one-half of the 170 tons of the combined resistances—that is, 85 tons against 24. The conclusion pointed to by these figures is that, while buckling tendency on the lee side of the holder may be taken at 24 tons, the force tending to keep them straight and vertical, owing to the tension induced by the outer lift, is as much as 45 tons—*i.e.*, half the weight of the suspended outer lift. Thus the first of the two factors is in itself more than sufficient to resist the power of the wind; the structural strength of the holder remaining in reserve.

Besides these two there is a third factor—viz., the strength imparted to the whole structure by the rigidity of the sheeting when inflated. The sides of a gasholder are, as is well known, constructed with strong vertical stays, frequently of channel-iron, connecting the plates at the top and at the bottom of each lift used in the construction of cups and dips or top and bottom curbs. The sheeting, which is placed on the outside, is frequently not attached to the stays. In an uninflated condition, the sheeting adds little to the strength of the shell; but the reverse appears to be the case when gas at considerable pressure is confined within. For the lee side of a gasholder to assume a convex shape (in elevation), the formation of corrugations in the side sheeting is essential—that is to say, the iron necessary for the bulging or leaning over of the lee side can only be obtained by a flattening of the sides of the holder.

If the top part of the second lift be considered to be forced over to the right by the great power of the wind, the sheeting would be found to be drawn into corrugations. The vertical stays on the lee side are greatly supported by the sheeting. The stays are attached at the top to the strong plates of the dip, to which the sheeting is also attached. In order to depart from the vertical, the stays through the heavy plating must drag upon a large area of sheeting. The sheeting on both sides of the holder, in order to admit of this movement, must, leaving its semicircular form, become flattened, and assume that of chords of arcs. This is prevented by the verticals, and also by the support given by the gas. While the former provides that no vertical contraction in the sides takes place, or any flattening in their immediate neighbourhood, it is the gas pressure within that renders the whole rigid, and so struts out the sides that they form a very efficient backstay to the lee-side verticals. The centre-post and back legs of a derrick crane seem to be to some extent a parallel. The strength of the inflated side sheeting, together with the two factors dealt with previously, appear to make up a very effective trio, interacting one with the other.

Passing next to the subject of gasholders without exterior framing, the author explained that no tension exists in the lower portion of the side of the outer lift of a holder, so that this could not be relied upon, as in the case when the second lift was being considered. In the case of the outer lift, the ability

to withstand the wind strain depends on the structural strength of the lift, and the rigidity imparted to it by the inflated sheeting. Referring to a diagram in which the wind pressure had been taken at 97 tons at 30 feet, and 50 tons at 15 feet, from the ground, and the induced compression at a point indicated at 40 tons, he said that, in a gasholder of ordinary construction of this size, there would be about 40 vertical stays of 6 in. by 3 in. by ½ in. channel iron, and each might be estimated to be capable of resisting a vertical compression of 19 tons. Taking the 20 vertical stays on the lee side as effective at the point named, there was a total effective resistance of 380 tons. He then went on to say: As suggested in the foregoing remarks, the side sheeting ties back the verticals, and this prevents them bending about the bottom curb to which they are fixed; and in this position they have the very great vertical resistance mentioned. The factor of safety of 9 : 1 shown by these figures (40 : 380 tons), leaves a margin for reduction on the score of too high an estimate of the efficiency of the channel-iron verticals. There is absolute proof that the outer lift, being able to sustain its own weight of 90 tons, is at least able to sustain a crushing force of 45 tons on the lee side, which in itself is 5 tons more than the estimated induced compression of the wind. There is, therefore, a sufficiency of strength by relying only on that absolutely shown to exist, and without the support of any estimate, however sound. Unless these arguments are altogether fallacious, there is a large margin of strength in an ordinarily constructed 180-feet diameter holder to withstand a gale of wind, without calling upon outside assistance to prevent distortion.

The concluding portion of the paper was devoted to an explanation of the wire-rope system of guiding gasholders. The author stated that a well-designed gasholder does not require any exterior aid to enable it to withstand the force of the wind, except that which is necessary to keep it in its working position. The vertical rise and fall had been usually secured by the use of columns; but this was a very expensive method. By doing without columns or wrought-iron standards, and arranging that the wind strain on the upper portion of the holder should be transmitted through the holder itself to the ground-line, a great saving in cost must obviously be effected. How this could be secured by means of steel ropes he then proceeded to describe by the aid of a diagram, showing in outline a single-lift holder in section, with one rope passing over the crown. He pointed out that three is the smallest number of ropes required for producing parallel movement in a holder; one rope checking irregular movement in a single direction only. He next showed the training of one rope, and explained that, if the circumference of a holder were divided into three equal portions by three ropes trained as that was, it would be impossible for the holder, under any circumstances, to rise or fall irregularly. The working of two ropes was shown by a model; and the threading of a rope on a two-lift holder was explained by a diagram. Another model showed four ropes on a two-lift holder; their function being to equalize the balance between the lee and windward sides. The supporting power of a single rope was briefly examined, as an interesting feature of the subject; and it was demonstrated that the way in which the rope was trained enabled it to do duty up to double its strength. Exemplifying this by a three-lift holder, 180 ft. by 90 ft., it was shown that, under the pressure of a 40-lb. gale, support to the amount of 36 tons would be wanted. It would therefore require a holder of this great size to strain nearly to breaking-point one ordinary ⅞-inch steel rope. Mr. Pease explained that this was given merely as an illustration of the power available in steel ropes in supplying the necessary support for large holders; but, in actual practice, such a holder would be supported by (say) eighteen ¾-inch ropes. These details in connection with the rope system might, he said, appear somewhat out of place in a paper which commenced with a criticism of the cost of modern holders; but perhaps they could claim admittance on the ground that the support of the holder was a very large item in the cost, and that the economy of using new means, or the wastefulness of the old, could not be estimated until the new method had substantiated its claims.

The paper was followed by a discussion, a report of which will be given next week.

The Summer Instructions of the Gas Referees.—The Notification which the Metropolitan Gas Referees have just issued for the coming summer is of special interest, inasmuch as, in addition to the usual intimation of the reduction in the maximum quantity of sulphur permissible in the gas from 22 to 17 grains per 100 cubic feet, the instructions lately issued in regard to candles are included. These, it may be remembered, were given in the JOURNAL for Dec. 19 last (p. 1133); and those now issued are, with a few changes, in the same terms. As the Referees have laid down definite rules as to the candles, the paragraph in the instructions as to testing for illuminating power which specified that they were to be as prescribed by the Metropolis Gas Act, 1860, has been altered accordingly. There are two additional appendices—one as to the method of washing the wicks, and the other as to determining the melting-point of the spermaceti.

MICHIGAN (U.S.A.) GAS ASSOCIATION.

First Annual Meeting at Grand Rapids.

This meeting was held on the 21st of February, under the chairmanship of the President—Mr. Sedgwick Dean, of Ann Arbor. One item in the report of the Executive Committee was a recommendation that a synopsis of the proceedings should be furnished to "the three gas journals" free of charge. This was adopted by the meeting, with an amendment to the effect that the President's address should be published in full. The "synopsis" simply gives the titles of the papers read, and states that discussions followed their reading. They were as follows: "How to Hold our Present Business and Gain New," by Mr. E. F. Gallagher, of Ionia; "The Scope and Aims of the Michigan Gas Association," by Mr. H. D. Walbridge, of Grand Rapids; "The Effect of Electric Currents upon Gas-Pipes," by Mr. H. W. Douglas, of Ann Arbor.

The President, in his address, contrasted the surroundings of the gas business thirty years ago with those of to-day. These were: 12 to 15 candle gas at 16s. to 25s. per 1000 cubic feet, sperm and tallow candles, and lard or fish oil at 5s. or 6s. per gallon, as compared with 20 to 35 candle gas at 3s. to 6s. per 1000 cubic feet, electricity at cost or less, petroleum at 3d. to 5d. per gallon, with greatly improved lamps. Yet, he said, their business was healthy, prosperous, and growing, and the object of the Association was to render the individual tact and skill that had made these results possible, the common property of the members. Addressing himself to the future of the gas industry, he said that petroleum was the strongest competitor gas suppliers had to encounter. He gave reasons for considering that this material could not be sold cheaper than it was at present; while improvements in lamps had been practically at a standstill for the last three years. Turning to electricity, so far from this being cheapened in the future, its price must be advanced, if dividends were to be earned by it; and its worst competition had been already experienced. In the new Welsbach burner, they had a cheaper and better light than could be furnished by either electricity or oil. Gas was the best agent for driving street cars—being stored under pressure in cylinders; and with gas at 4s. 6d. per 1000 cubic feet, the cost was 3¼d. per train-mile. Gas should be sold at low rates for power purposes; and he argued at considerable length in favour of a sliding scale of discounts according to the quantity of gas used. Attention was directed to the conclusions arrived at in the report on gas-stoves recently issued by the *Lancet* in London. In conclusion, the President emphasized the importance of supplying good gas, pushing every possible improvement in appliances, and giving careful attention to every detail of the business.

THE RELATIVE ECONOMY OF PETROLEUM, GAS, AND ELECTRICITY AS LIGHTING AGENTS.

A short time ago, an address on the above subject was delivered to an Association of Engineers composed of former students at the special schools at Ghent, by M. Verstraeten, President of the Association, and General Director of the Belgian Gas Lighting and Heating Company. The address has been printed as an extract from the Transactions of the Association, and a copy has been forwarded to us. The task M. Verstraeten set himself was to examine, from an economical point of view, the three lighting agents now generally in use—viz., petroleum, gas, and electricity—and he investigated the subject with considerable care. In making his calculations, he took, on the one hand, the expenses of first establishment, sinking fund, and maintenance; and, on the other, the cost of liquid, fluid, or current. These he reduced to the Carcel unit, and then proceeded to consider each illuminant separately, and to apply it first to a group of small installations of 10 Carcels, working on an average 600 hours per annum, and then to another group of 100 burners, working on an average 1000 hours annually. The gas-burners considered by M. Verstraeten were of the batswing, Argand, regenerative, and incandescent types; and arc and incandescent systems of electric lighting were compared with them. As the result of his researches, he arrived at the following figures as the cost per Carcel-hour for the small installations, with the most improved appliances: Petroleum lamp, 1·01c.; Argand burner (Bengel-Sugg), 1·49c.; small regenerative burner, 1·20c.; incandescent gas-light, 0·70c.; incandescent electric lamps, 5·02c. Considered from the point of view of economy, he places them in the following order: Incandescent gas-light, 1·00; petroleum lamp, 1·58; small regenerative lamp, 1·70; Argand burner, 2·10; incandescent electric lamp, 7·18. Consequently, in Brussels, supposing the production of electric current to be remunerative, the light afforded by it, when emitted horizontally by an incandescent lamp, costs seven times as much as that afforded by a Welsbach gas-burner. Taking the larger installations, M. Verstraeten found the cost per Carcel-hour to be as follows: Petroleum lamp, 0·90c.; Argand burner, 1·44c.; large regenerative burner, 0·62c.; incandescent gas-light, 0·63; incandescent electric lamp, 4·37c. In all these cases the emission of light was horizontal, with the exception of the large regenerative burner, in which it was vertical. Placing

these appliances in their economic order, we have: Large regenerative lamp, 1·000; incandescent gas-light, 1·041; petroleum lamp, 1·449; Argand burner, 2·318; incandescent electric lamp, 6·992. Electricity would therefore still cost seven times as much as gas consumed on the regenerative or the incandescent system. M. Verstraeten next brought into comparison two arc lamps—a 4 ampère and a 10 ampère—without opaline globes, with the following results per Carcel-hour for 1000 hours' lighting, leaving out of consideration conduits, meters, and fixed supports: Petroleum lamp, 0·960c.; incandescent gas-light (2·5 Carcels), 0·613c.; regenerative lamp (10 Carcels), 0·610c.; small arc lamp, 1·204c.; large do., 0·769c. Considered economically, the lamps stand thus: Large regenerative lamp, 1·00; incandescent gas-light, 1·05; large arc lamp, 1·26; petroleum lamp, 1·57; small arc lamp, 2·00. These figures show that Brussels gas, when properly employed, is cheaper than petroleum at 10c. per litre (1·14d. per quart), only half as costly as the small arc lamp, and much more economical than the larger one. M. Verstraeten thinks that, in view of the progress made during the past few years in connection with the three systems of lighting investigated, the future may possibly have some surprises in store; but he shows, by means of a table, that the yield of light is still very low. For instance, he states that a good petroleum lamp utilizes, for the production of luminous rays, only 1-224th part of the total calorific energy put into it. The ordinary batswing burner is a still more wasteful appliance, seeing that it gives out, in light, only 1-364th part of the heat-units confided to it. The yield of the Welsbach burner is nearly six times, while that of the incandescent electric lamp is more than twenty times, and of the arc lamp nearly a hundred times, that of the batswing burner. It is only arc lamps, therefore, that furnish a really presentable yield. M. Verstraeten remarks that considerable progress will have to be made with all the other burners; but he thinks this will be accomplished. Judging by recent experience, he finds that it is gas which, in the utilization of energy, by incandescence, has taken the greatest step in advance; and he is of opinion that further improvement will be effected, and the appliance cheapened. He does not find any similar evidence of advance by petroleum or electricity. The latter has its special properties as an illuminating agent; but, as he says, the main point is whether or not there will be a really genuine demand for it. To his mind, the examples afforded by the large towns are not particularly encouraging; while in the small ones there is not very much scope for electricity. However, if electricians fail, gas suppliers may be successful; and their existing plant, staff of officials, and long establishment ought to give them a certain advantage. M. Verstraeten thinks that, where a supply of electricity is demanded, gas companies should put clearly before the public the advantages, inconveniences, and cost of the new system, so as to avoid needless expenditure—perhaps waste—of money.

THE SCIENCE AND PROGRESS OF GAS COMBUSTION.

Discussion on Mr. Bellamy's Paper.

In the JOURNAL last week (p. 571), we gave an abstract of the paper on the above-named subject recently read by Mr. C. R. Bellamy before the Liverpool Engineering Society. As already mentioned, it gave rise to a discussion, a few points in which are given below.

The first speaker was Mr. A. Bromley Holmes, M.Inst.C.E, Managing-Director of the Liverpool Electric Supply Company. He thanked Mr. Bellamy for his paper, which, he said, showed some astounding advances in gas lighting. He thought, however, that gas was objectionable as an illuminating agent, especially as a vitiator of the atmosphere, and on account of the consumption of oxygen which was continually going on. He asked the author if he could give any figures as to the quantity of oxygen consumed by the incandescent gas-burner. Mr. Bellamy had incidentally alluded to a paper contributed to the Society, in which a comparison had been made between the cost of gas and that of electricity. That paper was written by him (Mr. Holmes), and the figures were calculated on an assumed yield of light of 4 candles per cubic foot of Liverpool gas; while he noticed that Mr. Bellamy's were based on results arrived at with the incandescent gas-burner, with its 19 candles per cubic foot. He thought the author's assumption that the cost of maintaining the mantle of the incandescent gas-light would not more than equal that of replacing the incandescent electric lamp was erroneous. He understood that a mantle cost 1s. 9d., while an incandescent electric lamp could now be obtained for 9d.; and he thought the life of the latter would be far greater than that of the former appliance. Another speaker (Mr. C. S. Pain, Assoc.Inst.C.E.) referred to the use of regenerative gas-lamps, which he said he had found very useful, in consequence of their causing no downward shadow. He had made several efforts to utilize them for ventilating purposes, by connecting them with a chimney flue; but he found this was impracticable owing to occasional down-draughts, deposits of soot, &c. He was anxious to ascertain whether the incandescent gas-burners could be turned down as easily as those of the ordinary form. Mr. T. L. Miller, Assoc.M.Inst.C.E., stated that he had ascertained from one of the agents of the Incandescent Gaslight Company that the estimated cost of maintaining one of their burners was 9s. per annum; and he thought that, if this amount were added to the charge for gas for that type of burner, it would equal, in point of cost, the ordinary form of burner. He considered the heat evolved by the incandescent gas-burner was greatly in excess of that of the ordinary form of burner; and he regarded this as an objection to its use. The President (Mr. H. Percy Boulnois, M.Inst. C.E.) said he desired to personally thank Mr. Bellamy for his excellent paper, and for the useful experiments he had performed during the evening. He thought they were most valuable from an educational point of view; and he regretted that the gas authorities had not been sufficiently alive to their own interests to recognize the importance of keeping their consumers posted with the best information available on the subject of gas combustion. It was of vital interest to gas consumers; and he thought the appointment of suitably trained inspectors, for the purpose of advising as to the economic use of gas, would be regarded as a great boon by the public, and would result beneficially to the companies.

In replying to the various speakers, Mr. Bellamy pointed out that one great advantage of the incandescent gas-burner was the lessened consumption of oxygen for the illumination obtained. The 60-candle light which was before them was maintained with a consumption of only 6 cubic feet of oxygen per hour; while for the maintenance of the same light with an ordinary flat-flame burner, 30 feet would be required. With reference to the cost of the mantle, he believed that the retail price was 1s. 9d., as stated; but he thought that Mr. Holmes had quoted the wholesale price for the incandescent electric lamps, which he did not think could be purchased separately for anything like 9d. each. With regard to the adaptability of regenerative lamps to ventilating purposes, he thought Mr. Pain's experiment had failed, not because the burner was unsuitable, but rather on account of the improper construction of the flue; and instances were given of different flue-tubes and cowls that were working with perfect satisfaction. The incandescent gas-burner could be readily turned down, as it was provided with a bye-pass jet rated at about 0·1 cubic foot per hour. As to the cost of maintaining an incandescent gas-light, he believed the Company were prepared to maintain them for 9s. per annum; but with this addition to the gas charge it was clear, upon reference to the diagram before them,* that the total annual cost would then be 50 per cent. less than in the case of the next best burner. In regard to the heat evolved, it was obvious that the ratio was lower for the light emitted than in the case of the ordinary type of burner. This was roughly demonstrated by placing the hand over different forms of burners adjusted to the same consumption.

A very cordial vote of thanks was accorded to Mr. Bellamy for his paper.

Death of Mr. T. C. Hopper.—Intelligence has lately reached England of the death, at Germantown (U.S A.), at the age of 67, of Mr. Thomas C. Hopper. Deceased, who was a native of Biddenden, Kent, went to Philadelphia in 1851, and became a member of the firm of Messrs. Code, Hopper, and Co., gas-meter manufacturers, which firm was subsequently merged in the American Meter Company, of which Mr. Hopper was President up to the time of his death. Deceased was very largely interested in many of the American gas companies; and his sons hold important positions in the gas undertakings of the United States.

Electric v. Incandescent Gas Lighting.—The subjoined remarks appeared in the *Electrician* for the 23rd ult.: "The following statistics, supplied by the Stockholm central electric station and by the Stockholm Electric Light Company, throw an interesting light upon the effect produced upon electric lighting in Stockholm by the introduction of the Auer gas-light in that city. The latter light was introduced in Stockholm in the autumn of 1892—the same time as the electric central station was opened. The immediate effect was the loss of a subscriber for twelve 16-candle power lamps. At the end of the year, the station was supplying a total of 4750 incandescent lamps, which during 1893 increased by 2650 lamps—making a total of 7500; the increase on the year being equal to 58 per cent. During the same year, the station lost two subscribers, with a total of eight lamps, who adopted the Auer burners. From Jan. 1 to Feb. 22 this year, there was an increase of 102 lamps, from which must be deducted the 21 lamps of one subscriber who went in for the Auer light. It will thus be seen that during all that time the central station only lost four subscribers, with an aggregate of 41 lamps, or about 0·5 per cent. The Stockholm Electric Light Company had at the beginning of 1893 a total of 5052 lamps of 16-candle power, which at the end of the year had increased to 5567 lamps. The Auer burners cannot, therefore, be said to have done the electric lighting establishments much harm, although there is reason to believe, says our Scandinavian correspondent, that the number of people requiring electric light would have been larger had not the Auer burners been in competition."

* The diagram referred to showed the cost of maintaining a gas light, or lights, having an illuminating power of 60 candles, for a year of 2000 lighting hours, with Liverpool gas, at 3s. 4d. per 1000 cubic feet, with various forms of burners. The figures are as follows: Incandescent gas-light, 20s.; regenerative lamp, 66s.; Argand burner, 86s.; governor burner, 100s.; ordinary No. 4 brass-cased fishtail burner, 214s.

REGISTER OF PATENTS.

Gas and other Internal Combustion Engines.—Davy, D., of Sheffield. No. 4696; March 3, 1893.

This is an engine on the same lines as the patentee's former invention—No. 3401 of 1893—its object being "to economize the consumption of gas or combustible vapour, by transforming into useful work a considerable portion of the heat (resulting from the combustion of an explosive mixture in a gas or other internal combustion engine), which would otherwise be carried off by the water-jacket." This is effected by causing the burning gases to heat and expand a relatively large volume of air, preferably interposed between the combustible charge and the working piston; the explosive charge and the air being compressed to about the same degree, but contained in different chambers, so as to remain separated until, by the ignition of the former, the burning gases are caused to expand into, mix with, and highly heat the air contained in the working cylinder—the surplus heat of the burning gases being thus converted into work by the expansion of the air. By thus separating the inflammable mixture in the combustion chamber from the compressed air contained in the working cylinder, until the point of ignition, a rich mixture may be used in the former, and yet a much larger aggregate proportion of air to gas may, it is claimed, be used than is possible in gas-engines of the "Otto" or similar type.

The working cylinder inhales and compresses air only, while the inflammable mixture is supplied to the combustion chamber by a pump; communication between the working cylinder and its combustion chamber being, if necessary, controlled by a valve opened from the engine-shaft, or by the force of the explosion, at such point in the compression stroke that the combustible charge is about to be (or has been) brought to the point of ignition, and remaining open during the working and exhaust strokes, and preferably during the inhaling stroke also—the mixed air and burnt gases exhausting from the cylinder through the combustion chamber.

In order that the engine may economically work upon the four-cycle principle, there are two working cylinders, each provided with a separate combustion chamber, and one pump supplying both; the phases of working in the two cylinders being so timed that the first phase in the one coincides with the third phase in the other, and so on. The pump meanwhile inhales and compresses at each revolution of the engine a combustible charge, which it delivers to the combustion chambers of the cylinders alternately; communication of the pump with the combustion chambers being controlled by valves.

Self-Acting Atmospheric Gas-Burner.—Smith, W. B., of Chelsea, S.W. No. 5312; March 11, 1893.

This invention (in the words of the patentee) consists "in heating a specially constructed cage of wire, or other material sufficiently refractious—*i.e.*, having sufficient heat-resisting properties—by means of a burner so constructed that the gas, with a quantity of air, issues at a high velocity; thus concentrating the flame, and resulting in an intense heat, rendering the cage incandescent. The action of the burner depends upon the energy due to the gas being above atmospheric pressure being used up in causing the mixed gas and air to issue from the outlet of the burner at a high velocity, producing a flame of intense heating power."

The cage is constructed without wires crosswise to the principal part of the flame—*i.e.*, where the principal heating of the wires takes place; all the wires being approximately in planes containing the axis of the flame. These wires are kept in their proper relative positions by two collars or rings, one at the bottom, and the other at or near the top of the cage. The bottom collar of the cage is free to move up and down, to allow for the expansion and contraction of the wires.

Measuring Liquids and Gases.—Bullough, C. T., of Brixton, S.W. No. 5487; March 14, 1893.

This apparatus consists of a double-acting cylinder, fitted with a leather packed piston and gland; or two single-acting cylinders could be used without the gland. The piston-rod, in the case of the double-acting cylinder, would be hollow in its length, with slides having a hinged piece attached to a link at one end, and with the other end hinged to the slide-valve, so as to impart a portion of the pistons' travel to it. The cylinder has the necessary ports and passages parallel to its bore; the middle or exhaust port being extended at its ends. The slide is of the ordinary D type, with a port at each end of its exhaust chamber. This communicates with a small cylinder upon the top of the slide-valve, fitted as the measuring cylinder. The piston-rod of the slide cylinder may be extended at both sides, so that it will fit between two parallel faces in the interior of the casing; but it engages into a T-slot on one side only. In applying this invention for gases, bellows would be used by the patentee after the usual manner in dry gas-meters.

The action of the apparatus is as follows: The piston of the measuring cylinder, attached to the hollow piston-rod, travels from one end of the measuring cylinder almost to the other. The hinged piece then touches at the end of the hollow piston-rod, and so imparts the necessary motion to the slide-valve. This opens one of the ports in the valve face, and causes the slide cylinder to move to the side, and so reverse the action. The meter having only one slide and one face, the action of which is rectilinear, the faces are kept in better order than if it moved in one direction only, and both cylinders used one common exhaust. The slide face may be cylindrical; the outside of the slide cylinder being turned a fit, so that it can be made to revolve backwards and forwards through a lever, rifle, or other means. The valve controlling the measuring cylinder ports would only need to have a slight spring behind it, so as to keep it tight; and the two ports in the slide cylinder would come alternately opposite ports in the slide casing, and so work the cylinder and slide over the measuring ports.

Railway Carriage Gas-Lamps.—Thomas, T. C. J., of Finsbury Park, N. No. 5865; March 18, 1893.

This invention relates to a railway carriage roof-lamp, constructed with one or more burners, arranged to burn in a closed globe, and carried by a jointed gas-supply pipe. The chimney casing (forming therewith an air-heating passage or chamber) and reflector-baffle are so arranged below the chimney as to prevent the direct upward passage of hot gases from the burners to the chimney, and so as to form with the chimney an exit passage for the hot gases. In escaping, these gases are caused to heat the wall of the air-regenerator; the parts being arranged so as to form a compound reflector, having no dark central space, and adapted to be readily removed from, and replaced within, the lamp casing as one piece, either with the jointed gas-supply pipe or independently of it.

Gas Cooking and Heating Stoves.—Pullar, A., of Norwood, and Leeds, L. W., of Berners Street, Oxford Street, W. No. 8585; April 28, 1893.

One form of stove constructed according to this invention consists of a bottomless chamber, provided with doors and with a heating device like that described in patent No. 5841 of 1886—that is, "luminous flame gas-jets burning in the open, beneath a refractory arch or overhanging block which may be faced or not with asbestos." Where the arches or blocks employed do not cover the top of the chamber, a sheet of asbestos is placed above, for the purpose of throwing down the heat. In this chamber, and below the gas-jets, are grooves for holding trays or pans, in which articles to be cooked by downward radiation of the heat are placed. Above this chamber, is a removable oven (having suitable inlets for the entrance of the heat), in which food may be cooked, water boiled, and the like—suitable arrangements being provided for the object aimed at. The lower or heating chamber may, if desired, be provided with a double casing, so as to retain the heat, and so form a boiler or water jacket, in which water may be heated; means being provided for drawing off the water, and for the escape of steam.

Gas-Engines.—Abel, C. D.; communicated from the Gas-Motoren-Fabrik Deutz, of Deutz, Germany. No. 9181; May 8, 1893.

This invention relates to means of regulating the speed of four-stroke-cycle gas motor engines, of the kind described in patent No. 4823 of 1890, where a chamber containing a flexible diaphragm, piston, or the like, was subject to the varying pressures occurring in the working cylinder, whereby it was moved so as to actuate a hit-and-miss device in conjunction with the discharge-valve of the engine and of a lever or rod actuated by the engine-shaft, in such a manner as to cause the valve to be opened during the discharge stroke of the engine piston, and to remain closed during the suction, compression, and firing strokes.

According to the present invention, the chamber, with its diaphragm or piston and hit-and-miss device, is utilized for regulating the speed of the engine in the following manner: The space in the chamber behind the piston or diaphragm is put in communication with the interior of the cylinder (or with the air-supply passage to the combustion space), by means of a pipe or passage, provided with a check-valve, which closes automatically after the air pressure in the chamber has either been reduced by the suction stroke of the piston, or has been increased by the compression stroke, so as to prevent the entrance or escape of air-pressure to or from the chamber.

The action of the apparatus thus arranged is as follows: Assuming the chamber to be provided with a flexible diaphragm, connected by a rod to a hit-and-miss lever pivoted to the discharge-valve, and to be put in communication with the air-supply passage of the explosion space of the cylinder by a pipe, with a check-valve that allows the air pressure to be withdrawn from the chamber by the suction stroke, but, in closing, prevents its re-entrance, then on the occurrence of the suction stroke, the diaphragm, in being forced inwards by the atmosphere on account of the reduced pressure in the chamber, will draw the hit-and-miss lever of the discharge-valve to one side, and will prevent it being forced open by the eccentric-rod during the return or compression stroke, as in the arrangement described in the 1890 patent. Instead, however, of the hit-and-miss lever being at once brought back into its normal position by the free re-admission of the air into the chamber, as was formerly the case, the air cock or valve on the chamber, being only slightly open, will restrict the entrance of the outer air, so as only to allow the diaphragm to move the lever slowly back into the normal position. This action is so timed that the hit-and-miss lever will only arrive in its normal position at the time the piston is at the end of its working stroke, so that the eccentric-rod can then force open the discharge-valve. From this arrangement, it will be seen that, if the engine is running too fast, the working stroke will have been completed before the hit-and-miss lever has arrived in the normal position, to be acted upon by the eccentric-rod, so that the latter will fail to open the discharge-valve. Consequently, the piston in performing its return stroke will compress the combustion gases in the cylinder; and on the following outstroke, these gases will expand again, and no combustible charge will be admitted. This action will be repeated until the speed of the engine has become reduced to the normal again, when the hit-and-miss lever will arrive in line with the eccentric-rod at the end of the working outstroke, and the discharge-valve will again be opened during the expelling stroke.

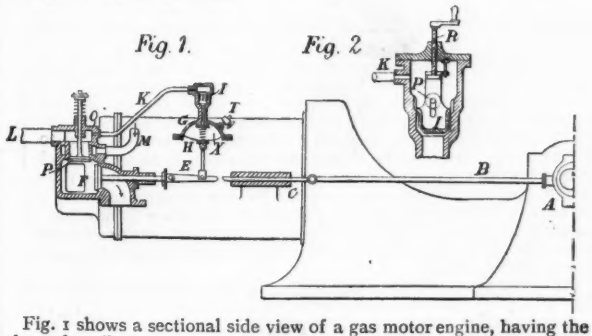


Fig. 1 shows a sectional side view of a gas motor engine, having the above-described improvement applied. Fig. 2 shows a modification,

in which the separate air-cock is dispensed with. The arrangement in both cases is supposed to be applied to apparatus shown in fig. 1 of patent No. 5273 of 1890.

Q is the mixing inlet-valve, which is supplied with air through the pipe L, and with gas through the pipe M, and which opens automatically on the suction stroke of the engine-piston. F is the discharge valve for the combustion gases, which is opened during the expelling stroke of the piston by means of the eccentric A on the crank-shaft, the eccentric-rod B, the reciprocating-rod C, and the hit-and-miss lever E, pivoted to the discharge-valve F, and connected to the flexible diaphragm H of the cup or casing G, the interior of which (as before described) is put in communication with the air chamber O by means of a passage K, so as to effect the moving of the lever E out of line with the rod C during the suction stroke of the piston.

According to the present invention, there is provided in the passage K a check-valve I, which opens freely during the suction stroke, for allowing the air to be exhausted from the cup or casing G, but which then closes, so as to prevent the re-entrance of the air. There is also provided on the cup G an air-cock T. Thus, with this arrangement, it will be seen that, during the suction-stroke, the consequent inward motion of the diaphragm H will draw the lever E out of line with the rod C, which will consequently fail to force open the discharge-valve F during the following instroke, so that the combustible charge will then be compressed.

At the end of the suction stroke, the valve I will close, so as to prevent the re-entrance of air into G through the pipe K; but, the cock T being slightly opened, air will penetrate slowly through it into the cup G; thus allowing the diaphragm to move slowly outwards again, assisted by a spring X. By this means, the lever E will be gradually brought back into the position in line with the rod C. This action is so regulated by the adjustment of the cock T, that the lever is brought into the position just before the commencement of the expelling stroke of the piston, when the engine is running at the normal speed, so that, at the commencement of it, the discharge-valve F will be forced open. If now the normal speed of the engine be exceeded, the rod C will advance for forcing open the discharge-valve before the lever E has arrived in the normal position, as the action of the diaphragm is constant and independent of the speed of the engine. Consequently, as the discharge-valve will remain closed, the piston will compress the combustion gases of the previous explosion by its instroke; and these will expand again during the following outstroke. The engine will thus continue to work without explosive charges until the speed has been sufficiently reduced for the lever E to be brought into its normal position again, by the time the rod C is being advanced towards it for opening the valve during the instroke of the piston. By increasing or decreasing the opening of the cock T, the normal speed of the engine can therefore be increased or decreased. In fig. 2 the air-valve T is dispensed with, and the regulated restricted re-entrance of the air into the cup G is effected by keeping the check-valve I slightly open. For this purpose, the valve I is suspended by a slotted connection from a pin P, that can be raised or lowered by a spindle R screwing through the valve casing; and the valve is provided with side channels which, when the valve is held slightly open, are made to communicate to a restricted extent with channels formed in the casing, so as to allow a more or less restricted flow of air back to the casing through the pipe K after the suction stroke. During the suction stroke, the valve is free to rise sufficiently, owing to its slotted connection with the pin P, to allow the air to be drawn freely from the casing G.

Preventing Water-Pipes Bursting in Time of Frost.—Bidder, G. P., of Palace Chambers, Westminster. No. 9539; May 12, 1893.

In his specification, the patentee says: "The bursting of a water-pipe in time of frost is caused, as is well known, by the expansion of the water when freezing. According to my present invention, I prevent such bursting of the pipes by combining therewith an inner pipe of smaller diameter, made of elastic material—or, preferably, a series of comparatively short cylinders of such elastic material, closed at the ends; such inner pipe or cylinders being filled with air at ordinary atmospheric pressure, or at a pressure proportionate to that of the water in the pipes. When cylinders are employed, these are provided with eyes or other means of attachment at the ends, so that they may be connected together in a longitudinal direction, so as to form a continuous chain of cylinders within the supply-pipe. When the temperature falls to freezing point, the more or less free expansion of the ice is provided for by causing it to compress the air cylinders, which are so adjusted in diameter as to enable them to take up the whole expansion due to the freezing of the water in the supply-pipe, without permitting the pressure to rise above a safe limit. The advantage of using separate cylinders of short length over the continuous pipe, consists in that, if an accidental perforation or leakage of a cylinder should occur, this merely puts that particular cylinder out of action, instead of permitting the whole pipe to be filled with water and rendered useless."

Retort-Lids.—Walker, C. C., of Donnington. No. 23,471; Dec. 6, 1893.

The object of this improvement on patent No. 6229 of 1884, is to provide means whereby more efficient rubbing action of the lid upon the rim of the mouthpiece is ensured, by making the eccentric boss which is upon the screw, and which engages in the corresponding recess in the lid, of less depth or thickness than hitherto, or than the depth of the recess; and by placing a flexible device (such as a coiled or bow spring) between the lid and the cross-bar, so as to keep the lid in contact with the rim of the mouthpiece during the final portion of the operation of the screw in closing the mouthpiece, and also during the first portion of the operation of the screw in opening the mouthpiece—during which times the eccentric boss gives an eccentric movement to the lid, ensuring a very efficient rubbing of the lid on the rim of the mouthpiece.

Fig. 1 is a plan, and fig. 2 is a section of the retort mouthpiece and lid. Fig. 3 is a part sectional view, drawn to a larger scale. Fig. 4 is a plan showing a different kind of spring.

Fig. 1.

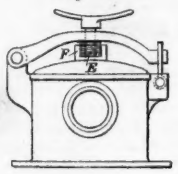


Fig. 2

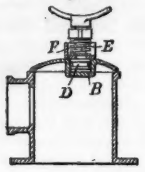


Fig. 3.

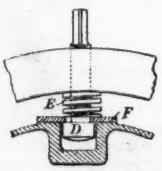
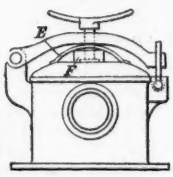


Fig 4.



Upon the screw passing through the bar for pressing the lid on to the mouthpiece is an eccentric boss D, which engages in the recess B in the lid—the boss being of less thickness than the depth of the recess. E is a coiled spring, placed between the lid and cross-bar. F is a plate or box, which takes the bearing of one end of the spring, and having an opening in it of sufficient size to allow of the working of the screw. In fig. 4 there is a bow or flat spring in place of the coiled spring. The spring in either case keeps the lid in contact with the rim of the mouthpiece during the final portion of the operation of the screw in closing the mouthpiece, and also during the first portion of the operation of the screw in opening it; so that the action of the eccentric, combined with that of the spring, gives, it is claimed, a very efficient rubbing action.

APPLICATIONS FOR LETTERS PATENT.

5092.—Williams, F., "Using small coke or breeze in the manufacture of coke and coke bricks." March 12.

5157.—Mawson, M., and Stuart, A., "Indicating by electricity the height of fluids in tanks or reservoirs." March 12.

5218.—Grice, H. J., and Rollason, E., "Constructing and governing gas-engines." March 13.

5326.—Breeze, G., and Gillard, W. B., "Gas-fires." March 14.

5439.—Johnson, H., "Globes or shades for gas, electric, and other lamps." March 15.

5455.—Pokutynski, S. de, "Water-meters." March 15.

5475.—Facer, J. and C. A., "Pipe joints or connections for cast or wrought iron or other pipes. March 16.

5493.—Southall, J., "Gas and oil motor engines." March 16.

5499.—Holt, H. P., "Gas motor or oil motor cars." March 16.

5527.—Cockburn, J., "Igniting the explosive charge in oil-engines and gas-engines." March 16.

5540.—Wilton, G., "Carbonization of coal in the manufacture of coal gas." March 16.

5621.—Menzies, J., "Coupling or joint for malleable iron and other tubes and pipes." March 17.

5693.—Allan, J., "Gas-engines." March 19.

5733.—Coutts, J. F., and Hughes, F., "Rapidly heating portable branding-irons and branding-stoves by means of incandescent gas-fires." March 20.

5843.—Binns, J. P. and H. G., "Gas and oil engines." March 21.

5916.—Pittler, W. von, "Gas and oil engines." March 21.

5963.—Melvin, A. M., "Stopcocks for gas fires or stoves, and other purposes." March 22.

6003.—Lange, E., "Oil and gas engines." March 22.

6058.—Glover, R. T. and J. G., "Valves of coin-freed apparatus for the sale of gas in fixed quantities." March 22.

6091.—Clarke, T. A. W., "Gas and oil motors." March 24.

6096.—Webb, W. Le P., "Gas and oil motor engines." March 24.

6138.—Reid, H. T., "Oil and gas engines." A communication from G. B. Brayton. March 24.

Kimberley Water-Works Company, Limited.—The accounts of this Company for the past year show a profit of £24,090. After payment of the interest on debentures and debenture stock, the net available profit is £17,490, out of which an interim dividend of 2½ per cent. has been paid. The Directors now propose to pay a further 2½ per cent.—absorbing, with the interim dividend, £15,750, and making 5 per cent. for the year—and to write off £1963. They state in their report that the decrease in the consumption, as compared with the previous year, is due to a smaller demand for water for mining purposes, the total cessation of operations for the time being in two important mines, and a consequent decrease in the population.

The Proposed Jetty for the Preston Gas Company.—The Board of Trade have presented to Parliament a report on the proposal contained in the Preston Gas Company's Bill to construct, in connection with certain other works, a wharf or jetty on the north bank of the River Ribble, at a point about 30 chains below the entrance to the tidal basin of the Albert Edward Dock. As the Board have received from the Preston Corporation, who are Conservators of the Ribble, a communication urging objections to the scheme, they are advised that it deserves the serious consideration of Parliament. The Corporation's objections are set out in an appendix to the report. They point out that the effect of the jetty, with a vessel moored to it, would be to reduce the navigable width of the river at that spot by 50 feet, and thus to interfere with the traffic to and from the dock; while the whole river traffic would, they say, be stopped during the manœuvring of vessels at the jetty. Another matter to which attention is called is that the proposed jetty is to be only 200 feet wide; and this is considered insufficient for safe moorings, especially during high floods

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Inventor of the Regenerative Burner.

SIR,—By inadvertence, I have only just seen the report of Professor Vivian B. Lewes's lecture on "The Consumption of Coal Gas for the Generation of Light," in your issue of the 6th inst.; and I notice that, on p. 439, it is stated that, "in 1853, Dr. Frankland, in one of his lectures at the Royal Institution, showed, but did not fully describe, an Argand burner in which the idea was first adopted of utilizing the heat which otherwise would have been lost, to raise the temperature of the air supply; and this burner was afterwards described in Ure's 'Dictionary'—the article, however, not being published till a year or so after it had been written. The burner consisted of an ordinary Argand; but, in addition to the usual chimney, it had a second external one, which extended some distance below the first, and was closed at the bottom by a glass plate, fitted air-tight to the pillar carrying the burner, so that the air needed to support the combustion of the gas had to pass down the annular space between the chimneys, and in its passage became highly heated—partly by contact with the hot inner glass, and partly by radiation. The temperature of the air finally entering the burner Dr. Frankland considered to be about 500° Fahr. In 1854, the Rev. W. R. Bowditch brought out a burner identical in nearly every respect with the one just described; and as this was brought prominently forward, it attracted considerable attention, with the result that the inception of the regenerative burner has been generally ascribed to Bowditch, while the honour is undoubtedly due to Frankland."

Now, as a matter of fact, this identical principle had already been patented by an engineer of the name of Chaussenot, of Leicester Square, in the year 1835. I enclose a copy of his specification for your perusal; and by it you will see that Frankland and Bowditch, who have respectively been looked upon as being the originators of the regenerative burner, were neither of them entitled to the honour, as Chaussenot had established the regenerative principle nearly twenty years previously to its so-called introduction by Dr. Frankland.

March 26, 1894. I. J. COLLINS, Managing-Director,
The Lamp Manufacturing Company, Limited.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Bills since our last report (*ante*, p. 531):—

Bills presented and read the first time: Aberdare Local Board Water Bill, Accrington Gas and Water Board Bill, Bacup Corporation Water Bill, Edinburgh and Leith Corporations Gas Bill, Falkirk Corporation Gas Bill, Kendal Corporation Gas and Water Bill, Millom Local Board Bill, Swindon Water Bill, and Swinton Local Board Bill.

Bills presented, read the first time, and referred to the Examiners: Abertillery Local Board Gas and Water Bill, Consett Water Bill, Falkirk and District Gas Bill, Newcastle and Gateshead Water Bill, and Pontypridd Water (Tramroad) Bill. (The Examiners subsequently reported that the Standing Orders applicable to these Bills had been complied with.)

Bills read a second time: Aberdare Local Board Water Bill, Abertillery Local Board Gas and Water Bill, Accrington Gas and Water Board Bill, Bacup Corporation Water Bill, Consett Water Bill, Edinburgh and Leith Corporations Gas Bill, Falkirk and District Gas Bill, Falkirk Corporation Gas Bill, Kendal Corporation Gas and Water Bill, Millom Local Board Bill, Newcastle and Gateshead Water Bill, Pontypridd Water (Tramroad) Bill, Swindon Water Bill, Swinton Local Board Bill.

Petitions against the following Bills have been presented:—

Edinburgh and Leith Corporations Gas Bill, from the Leith Harbour and Docks Commissioners.

Newcastle and Gateshead Water Bill, from the Board of Conservators for the Fishery District of the River Tyne and the Tyne Improvement Commissioners.

Swinton Local Board Bill, from the Dearne Valley Water Company.

HOUSE OF COMMONS.

The following progress has been made with Bills since our last report (*ante*, p. 531):—

Alloa Water Bill read the first time, and ordered for second reading.

Standing Orders complied with, and Bills ordered for second reading: Carshalton and Croydon Gas Bill, Chesterfield Water and Gas Bill, East London Water Bill, Harrow and Stanmore Gas Bill, Hebden Bridge Gas Bill, Paignton Gas Bill, Plymouth and Stonehouse Gas Bill, Southend Water Bill, South Hants Water Bill, and West Middlesex Water Bill.

Bills read a second time and committed: Alloa Gas Bill, Bury Corporation Bill, Carshalton and Croydon Gas Bill, Chesterfield Water and Gas Bill, Dundee Corporation Bill, Fulwood Local Board (Water) Bill, Gloucester Corporation Bill, London County Council (General Powers) Bill, Neath Corporation Water Bill, Paignton Gas Bill, Plymouth and Stonehouse Gas Bill, and South Hants Water Bill.

Mr. J. Stuart has given notice to oppose the second reading of the East London Water, Southwark and Vauxhall Water, Thames Conservancy, and West Middlesex Water Bills; and in the event of his opposition being unsuccessful in the case of the Thames Conservancy Bill, he will move after the second reading—"That it be an instruction to the Committee to amend the Bill so that no Water Company shall obtain power under the Bill to appropriate or divert water from the Thames in excess of any limits now fixed by Act of Parliament." Mr. Bonsor will also oppose the second reading of this Bill.

The following additional private members' Bills have been presented and read the first time:—

Factory and Workshops Act (1891) Amendment Bill, Joint-Stock Companies' Register Bill (to enable the Registrar of Joint-Stock Companies to remove the names of companies from the register in certain cases), Rivers Pollution Prevention Bill.

Petitions against the following Bills have been presented:—

Ambleside District Gas and Water Bill, from the Ambleside Local Board and the Corporation of Manchester.

Bury Corporation Bill, from the Haslingden Corporation, the Mersey and Irwell Joint Committee, and the Earl of Wilton.

Carshalton and Croydon Gas Bill, from the Corporation of Croydon.

Chesterfield Water and Gas Bill, from the Brampton and Walton Local Board, the Local Boards of Newbold, Dunston, and Whittington, the Corporation of Chesterfield, the Chesterfield Rural Sanitary Authority, the Derby County Council, the Midland Railway Company, and Owners, &c., of mills, &c., and riparian proprietors on the River Hipper.

Colne Valley and Central Middlesex Water Companies, from the Conservators of the River Thames, the Corporation of London, and the Hertfordshire, London, and Middlesex County Councils

East London Water Bill, from the Corporations of London and West Ham and the Essex County Council.

Gloucester Corporation Bill, from the Gloucester County Council, the Newent Rural Sanitary Authority, and the Severn Commissioners.

Harrow and Stanmore Gas Bill, from the Harrow Local Board and consumers of gas supplied by the Harrow District Gas Company.

Hebden Bridge Gas Bill, from the Hebden Bridge and Mytholmroyd District Local Boards.

Neath Corporation Water Bill, from the Earl of Jersey, "A" shareholders in the Neath Water Company, and the Briton Ferry Local Board.

Paignton Gas Bill, from Occupiers of dwelling-houses and others.

Plymouth and Stonehouse Gas Bill, from the Corporation of Plymouth.

Preston Gas Bill, from the Corporation of Preston, Sir James de Hoghton, Bart., Montague J. Fielden, Robert Ireland Blackburne, and the National Electric Supply Company.

Southwark and Vauxhall Water Bill, from the Conservators of the River Thames, the Corporations of London and Richmond, the Heston and Isleworth Local Board, the London and Middlesex County Councils, the Sunbury Gas Company, the Twickenham Local Board, the Lambeth Vestry, and the Kent Water Company.

Thames Conservancy Bill.—About a hundred petitions have been presented against this Bill, among the petitioners being the East London, Southwark and Vauxhall, West Middlesex, and other Water Companies; the West Surrey Water Company; The Gaslight and Coke Company; and the London County Council.

West Middlesex Water Bill, from the Corporation of London and the London County Council.

A petition for inquiry into the working of the Metropolitan Gas Companies has been presented from Hendon.

The Cardiff Gas Company and the Public Lighting.—The dispute between the Cardiff Corporation and the Gas Company (to which reference was made in the JOURNAL last October) has now been brought to an end by the conclusion of an agreement, by which the former body have taken over the lighting, cleaning, repairing, and extinguishing of the street-lamps.

The Gas Workers' Union.—The fifth anniversary of the formation of the Gas Workers' Union was celebrated on Sunday, the 25th ult., at Canning Town. The proceedings began with a procession from the Canning Town Railway Station to Morley's Corner—a piece of open ground near East Ham—where two platforms were erected. It is estimated that 10,000 people were present. At the first platform, Mr. Mark Hutchins, the President of the Union, took the chair. Mr. J. O'Connor (Secretary of the Coal Porters' Union) proposed—"That this mass meeting of trade unionists and others heartily rejoices at the rapid progress that the labour cause is making all over the world, and hereby pledges itself to remove by trade unionism and political effort the many evils which exist to-day." Mr. W. Thorne (Secretary of the Gas Workers' Union), in supporting the motion, said he was one of those who thought the workers could get all their grievances remedied by constitutional means, if they would only take steps to make the fullest use of those means. Mr. W. Crooks said the gas workers had been the pioneers of the eight-hour movement; and he hoped they would keep on fighting in the van until they obtained a universal eight-hour day for all trades. Mr. Keir Hardie, M.P., spoke in favour of the motion, which was carried unanimously. At the second platform, Mr. P. Curran presided. He said that for the past five years their Union had been fighting not only for gas workers, but for all classes of unskilled labour. Notwithstanding the widespread depression in trade, the Union was financially stronger than it had ever been before. They claimed to be the pioneers of the New Unionism; and they had never ceased to insist upon the fact that labour must be politically organized on a national and international basis before it could secure its rights. Mr. T. M'Carthy proposed the above resolution. It was seconded by Mr. W. H. Ward (Assistant-Secretary of the Union), who stated that their income for the past year had been £11,326. They had now a balance in the bank of £5993, against £4643 at the end of 1892. The motion was carried unanimously, and the meeting broke up with cheers for the cause of labour.

MISCELLANEOUS NEWS.

STRIKE AT THE VIENNA GAS-WORKS.

A rather alarming announcement appeared in the London papers on Friday morning, to the effect that, owing to the dismissal of a workman, 150 of the men employed at one of the stations of the Imperial Continental Gas Association in Vienna struck work on the previous day; their example being followed later on by the employees in almost all the gas-works in the city. The real cause of the strike was, we believe, a desire for an eight-hour day with increased wages; and the dismissal of the man was seized upon by the local Union merely as a pretext for enforcing their demands. The Social Democratic Congress was being held in the city at the time; and the intention of the men was announced thereat, and applauded. Altogether, about 2000 men ceased work; but 600 refused to do so. Foreseeing the possibility of trouble, arrangements were made for replacing the strikers; and as a large number of unemployed men offered their services, no stoppage of work occurred. Prompt measures were taken to protect the works and the new hands. On Friday, some 200 men were conveyed into the works by special train from Moravia; and further detachments were expected. A deputation from the strikers sought an interview with the officials; but this was not granted, as they were determined not to negotiate on the question of the engagement or the dismissal of workmen. Only those men whose services have been entirely satisfactory in the past, and who apply individually to be re-engaged, will be taken back. With regard to the wages question, it seems that only about a month ago a demand was made for an increase; and it was at once conceded. The present rate of pay for unskilled labour is 2s. 6d. a day, and for stokers from 4s. 2d. to 5s. per day, which is considered to be very good in Austria. The authorities, who have been appealed to by the men, have declined to interfere, on the ground that there was no justification whatever for the high-handed action. The strike was generally regarded as a colossal blunder; and the justness of this estimate of the affair was shown by the fact that on Saturday the strikers went in a body to the officials and asked to be taken back, without conditions. Of course this request was not granted. The correspondent of a London "Labour" paper, referring to the matter, says: "Anything more lamentable than this ill-advised strike could hardly be conceived; and it happens most unfortunately for the cause of Austrian labour, coming as it does at the close of the Labour and Socialist Congress, the divisions in which it naturally emphasizes."

PRESENTATION TO MR. H. TAPLAY.

At the North Stafford Hotel, Stoke, last Thursday, the friend of Mr. Herman Taplay, the former Manager of the Stoke Corporation Gas-Works, entertained him at dinner, and presented him with a testimonial expressive of their regard for him, and their regret at the circumstances which led to the severance of his connection with the gas undertaking. Alderman KIRKHAM, J.P., presided; and Mr. Taplay occupied a seat on his right. There was a large attendance.

Several letters of apology for unavoidable absence were announced; one being from Mr. T. Roberts, Surveyor to the Duke of Sutherland, who wrote as follows: "I believe the Duke of Sutherland is one of the largest consumers of gas (under my supervision) supplied by the Corporation of Stoke-upon-Trent during the last 20 years, including Mr. Taplay's office as Manager and Gas Engineer. I have had no reason of complaint either in attention or courtesy, or in the supply of gas in due quantity or quality, in lighting power or purity. The gas-fittings at Trentham Hall and other large houses, churches, and chapels on this estate have been to my entire satisfaction, and I am sure with due regard to the interest of the Corporation. I regret very much Mr. Taplay's position. It will be a difficult matter to replace him with a better man."

The loyal and other toasts having been duly honoured,

The CHAIRMAN proposed—"The Health of our Guest." In doing so, he said they had met to assure Mr. Taplay of their own unabated confidence in him, He (Alderman Kirkham) was still a member of the Town Council; and therefore he wished to be very guarded in what he said, as it might at any time be brought up against him that he, the oldest member of the Council, had said anything against it. When he mentioned that Mr. Leason was the Chairman of the Gas Committee for very many years, and undoubtedly knew more about the Gas Manager and the management of the gas-works than anyone else, they would excuse him doing more than tell them how deeply he respected the honour and integrity of the gentleman who was there that night, but who was no longer the Manager of the Stoke Gas-Works. He might tell them that it was an open secret that this result was the outcome of a threat made some years ago. He was disposed to think that had Mr. Leason maintained his position on the Council, this unfortunate matter would never have occurred. He was so utterly disgusted with certain members of the Gas Committee, that he retired; and this he (the speaker) considered a loss to the town. He hoped that, in the near future, he would take the same course; for he considered it no longer an honour to be a member of the Stoke Town Council. He wished to advert to one matter which had weighed on his mind for some months. There had been grumblings and complainings which had fairly worried the life out of their Manager; but the first serious thing that took place was the contract respecting the coal. He had his own opinion about the matter. The Council made a mistake in buying an inferior coal; and because the Manager was unable to get the same result from it as before, it was put down as his fault. During the whole course of these disputes, not a single charge of any kind was made against the Manager as to neglect of duty or incapacity to perform his work. To his mind, there were two reasons for this. The first was that they could not make any charge against him of neglect of duty; and the second was that they were afraid, because if they had made an unjust charge against him he was prepared to take the necessary steps to vindicate himself. There was another matter, and that was a requisition had been signed and sent to the Mayor, asking for a public meeting to be called to investigate this question; but no notice had been taken of it. They could prove at a meeting that nine-tenths of the burgesses of the town altogether disapproved of the action of the Gas Committee; and therefore the action of the Town Council was not that which would have been the action of the inhabitants of the town. In conclusion, he would assert that there were no gas-works in the three kingdoms with the same capital which had made such a large profit during Mr. Taplay's managership as the works in Stoke.

Mr. G. LEASON said he was one of those who inspected the gas-works prior to the Corporation taking them over; and he had been a member of the Gas Committee. While occupying this position, he saw the vicious feeling entertained towards the Manager. There had been a reference to his leaving the Town Council. Well, one of his reasons was the bitter contempt in which he held some members of the Gas Committee. The Committee went so far as to treat the Manager in a wholly insulting manner; and what could one do when mistrusted by one's employers? The position was absolutely intolerable. If he had any idea of the public opinion of the town, it had condemned the action of the Council. It was to his great pleasure and delight that he now handed Mr. Taplay a cheque for 100 guineas, which had been freely contributed to by his many friend without any canvassing whatever.

Mr. E. V. GREATBATCH said that Stoke had established for itself a most unhappy and disgraceful record in regard to its Gas Managers. In thirteen years it had hounded one to the lunatic asylum and thence to the grave, and had now put the second one out of office. For his own part, he believed that the welfare of the borough had nothing whatever to do with the opposition to Mr. Taplay. He firmly and solemnly believed that the malice of one man was at the bottom of it. He had waded through the records of the Gas Committee, and he could not find that a single charge of any sort was made against Mr. Taplay; and, though there had been several insinuations, he had never been reprimanded. The requisition which the Mayor had received had been put aside in silent contempt. He concluded by expressing the opinion that no town need have a better gas manager than Mr. Taplay; and the borough that gained his services would have an exceedingly good man. He then presented Mr. Taplay with a testimonial, which was as follows:—

Stoke-on-Trent, March, 1894.

Mr. HERMAN TAPLAY.

Dear Sir,—We have viewed with great regret the action of a portion of the Town Council of this borough in compelling your retiral from the position of Engineer and Manager of the Stoke-upon-Trent Gas-Works, and have no hesitation in saying that, in our opinion, that action was the result of causes for which you were in no way to blame, and which did not in the least reflect upon your honour or integrity, or detract from your admitted capacity and efficiency as Engineer and Manager. For nearly thirteen years, you have managed the gas-works in a highly satisfactory manner. The town has been exceedingly well lighted; and, although during that time the price of gas has been reduced 6d. per 1000 and meter-rents abolished, the profits have been amongst the largest on record during that period, whilst the loss from leakage has been reduced from a high percentage to practically a minimum. Indeed, the gas-works has produced most gratifying results in every way whilst it has been under your charge. We have great pleasure in testifying to the highly creditable and successful career which you have maintained here, and regret that the borough has lost the services of such an excellent officer.—(Signed) W. Kirkham, J.P., C.C., Alderman and ex-Mayor (thrice) of the borough, and present member of the Gas Committee; Geo. Leason, J.P., thrice Mayor of the borough, and for nine years Chairman or Vice-Chairman of the Gas Committee during Mr. Taplay's management; W. Boulton, Alderman and past Mayor of the borough; Edw. J. Leadbeater, Alderman of the borough; Chas. S. Jones, town councillor and present member of the Gas Committee; J. B. Beardmore, do.; E. V. Greatbatch, do.; T. R. Yoxall, do.; Richard Raynes, town councillor; John Woolliscroft, do.

Mr. TAPLAY, on rising to respond, was received with loud cheers. He said that, though this might not be the proudest moment of his life, it was the most honoured, when gentlemen of all shades of opinion assembled as a protest against the wrongs that had been done him. These wrongs, he might say, were doubly acute, since they had been done him after thirteen years of faithful service. The whole matter had been cut and dried. The Gas Committee had inquired into his conduct; but in what manner? Not in the English manner, in open court, but in Star Chamber fashion. Mr. Taplay went on to narrate the facts concerning the purchase of the coal, and stated that he invited the Committee to bring a competent man to the works and say whether he had tampered in any way. He was told they were going to do this; and he rejoiced thereat until he found that they intended to bring in simply a working man from a neighbouring works, and then he looked upon the thing as a gross insult to himself. He concluded by referring to other well-known circumstances connected with his dismissal; and expressed his gratitude to those present for the honour they had done him.

Other toasts followed, and the proceedings closed.

Claim against the Southwark and Vauxhall Water Company for Compensation.—At the Lambeth Police Court last Tuesday week, Mr. Hopkins gave his decision in regard to a summons taken out under the Lands Clauses Consolidation Act, 1845, by which Mr. W. J. F. P. Burnett, the lessee of Lanksford Cottage, Smith's Lane, Peckham, sought to recover compensation from the Southwark and Vauxhall Water Company for injury to the premises sustained by reason of the execution of certain works by the Company. Mr. Hopkins remarked that, although the damage said to have been caused by the laying of the Company's mains occurred as far back as 1891, the summons was not taken out until the present year. As to the extent of the damage, the parties' views were widely divergent. They both called surveyors; and the surveyors would forgive him if he said they were called, one to make a case, and the other to answer it. The conclusion he had come to was that some damage had been done to the house by the works in question; and, consequently, there must be a verdict for the plaintiff for £7 10s. and £5 5s. costs.

COMMERCIAL GAS COMPANY.

The One Hundredth Half-Yearly Report.

The following is the report of the Directors of this Company, which, with the accounts for the six months ending Dec. 31 last, will be presented at the half-yearly general meeting next Thursday:—

The Directors submit the accounts for the half year ending Dec. 31, 1893. The revenue account shows a net profit for the half year of £59,132 5s. 10d.; making, with £627 1s. 7d. received for interest, £59,759 7s. 5d. This, added to the amount brought forward from the previous half year, makes £62,754 3s. 1d. Deducting therefrom £3712 10s. for interest on debenture stock, there remains standing to the credit of the net revenue account a balance of £59,041 13s. 1d. available for dividend. The Directors recommend the payment of dividends at the rate of 12½ per cent. per annum upon the old stock of the Company, and of 9½ per cent. per annum upon the new stock, both less income-tax. The balance of the net revenue will be carried forward to the next half year.

The accounts accompanying the report consist of the usual statements. The statement of capital stock (No. 1) stands as before—viz., £715,000 paid up, out of a total of £830,000 authorized. The statement of loan capital (No. 2) is also unchanged—£165,000 borrowed, out of £300,000 authorized. The capital account (No. 3) shows receipts to the amount of £880,000, out of which a total of £861,094 14s. 8d. has been expended—£2188 18s. 7d. having been laid out in the six months covered by the report. The bulk of this (£1129) was for the purchase and fixing of prepayment meters. The balance in hand is £18,905 5s. 4d. The remaining statements in the accounts are reproduced below.

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—				By Sale of gas—			
Coals, including dues, carriage, unloading, and trimming (see account No. 8)		£64,470 18 11		Common gas, per meter, at 2s. 9d. per 1000 cubic feet		£126,581 11 2	
Salaries of Engineers, Superintendents, and other Officers at works		2,146 3 4		Public lighting and under contracts, common gas. (See statement No. 10.)		9,409 1 8	
Wages (carbonizing)		17,890 5 8					£135,940 12 10
Purification, including £1886 9s. for labour		4,124 17 10		Meter-rental		£2,020 5 11	
Repairs and maintenance of plant and works, materials and labour (less £69 8s. 2d. received for old materials)		19,388 5 11		Stove and coin meters and fittings' rental		873 19 9	
			£103,020 11 8				2,893 5 8
Distribution of gas—				Residual products—			
Salaries and wages of Officers (including Rental Clerks)	£1,496 15 1			Coke, less £3068 2s. 10d. for labour		£34,233 7 4	
Repairs, maintenance, and renewals of mains, service-pipes, and fittings, including labour	5,387 1 5			Breeze, less £442 15s. 1d. for do.		491 0 7	
Repairs and renewals of meters	1,580 16 3			Tar		7,411 3 1	
" " stoves, coin meters and fittings	1,110 18 9			Ammoniacal liquor and sulphate		10,882 10 11	
		9,575 11 6					53,018 1 11
Public lamps—				Miscellaneous receipts—			
Lighting and repairing		2,325 14 1		Rents		£136 8 10	
Rent, rates, and taxes		6,216 6 2		Transfer fees		25 7 6	
Management—							161 16 4
Directors' allowance	£1,250 0 0						
Company's Auditors	75 0 0						
Salaries of Secretary, Accountant, and Clerks	1,117 2 0						
Collectors' salaries and commission	1,477 5 5						
Stationery and printing	422 14 6						
General charges	364 18 3						
		4,707 0 2					
Bad debts		973 1 0					
Law and parliamentary charges		390 15 2					
Superannuations		600 0 0					
Official Officers		72 11 2					
		£132,881 10 11					
Balance carried to profit and loss net revenue account (No. 5)		59,132 5 10					
		£192,013 16 9				£192,013 16 9	

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on debenture stock	£3,712 10 0	Balance, June 30, 1893	£45,209 5 8
Balance available for dividend, carried to balance-sheet	59,041 13 1	Less—Amount of dividend paid for half year ending June 30, 1893, including penalty of £2	42,214 10 0
			£2,994 15 8
		Balance from revenue account (No. 4)	£59,132 5 10
		Dividends and interest balance	627 1 7
	£62,754 3 1		£62,754 3 1

No. 6.—RESERVE FUND.

Balance on Dec. 31, 1893	£38,014 14 6	Balance on June 30, 1893	£38,014 14 6
	£38,014 14 6		£38,014 14 6

No. 7.—INSURANCE FUND.

Balance on Dec. 31 1893	£28,652 7 7	Balance on June 30, 1893	£28,652 7 7
	£28,652 7 7		£28,652 7 7

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, June 30, 1893.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, Dec. 31, 1893.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	37,440	92,318[10]	102,096[10]	150	27,512
Cannel	4,351	—	1,122*	—	3,229
	41,791	92,318[10]	103,218[10]	150	30,741

* 110,218 gallons of petroleum spirit (lower grade) used as a substitute for cannel.

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

	In Store, June 30, 1893.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, Dec. 31, 1893.
Coke—tons	360	62,618	16,634	43,641	2,703
Breeze—do.	280	10,187	3,000	6,617	850
Tar—gallons	201,800	1,040,280	—	990,850	251,230
Ammon. liq.—butts of 108 gals.	6,390	35,090	32,865	—	8,615
Sulphate of ammonia—tons	91	1,051[15]	—	1,010[15]	142

No. 10.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity Made. Meter Register.	Quantity Sold. Public Lights and under Contracts (estimated).	Quantity Sold. Private Lights (per Meter).	Quantity Sold. Total Quantity Sold.	Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	1,085,818	59,242	920,286	979,528	14,211	993,739	72,079	5,385

BALANCE-SHEET.

To Capital—				By Cash at Bankers		£4,144 16 1
For balance, per account No. 3		£18,905 5 4		Cash in hand for current expenditure		2,950 0 0
Net Revenue—				Amount invested in Consols		66,667 2 1
For balance, per account No. 5		59,041 13 1		Stores in hand—		
Reserve Fund—				Coals	£20,301 6 3	
For balance, per account No. 6		38,014 14 6		Coke and breeze	1,596 14 6	
Insurance Fund—				Ammoniacal liquor and tar	5,621 0 0	
For balance, per account No. 7		28,652 7 7		Sundries	7,226 5 5	
Unclaimed dividends		1,993 1 1				31,645 6 2
Deposits		9,161 17 7		Accounts due to the Company—		
Interest on debenture stock		223 15 0		Gas-rental, quarter ending Dec. 31, 1893	£83,920 19 2	
Sundry tradesmen and others, for amount due for coals, stores, and sundries		22,612 16 1		Arrears outstanding	1,140 0 0	
						85,060 19 2
Loan from Bankers		25,000 0 0		For coke and other residual products	£9,300 15 11	
				Sundries	836 10 10	
						10,137 6 9
		£203,605 10 3				£203,605 10 3

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Half-Yearly Report and Accounts.

Last Saturday, the shareholders of the above Company held their half-yearly meeting, the proceedings at which will be recorded in our next issue. In the meantime we give the following particulars from the report and accounts which were presented. The former stated that the receipts amounted to £137,680; and the expenditure, to £97,517—leaving a balance of £40,163. From this there had been deducted £5271, to pay interest on loan capital, &c.; leaving £34,892 available for distribution. The Directors recommended the payment of the usual dividends at the rate of 10½ and 7½ per cent. per annum on the respective shares, after which there remained £1180 to be carried forward. Compared with the corresponding period of the previous year, there was a reduction of about 1½ per cent. in the quantity of gas sold. This falling off was attributed to the high temperature and the bright days which prevailed during a large portion of the half year. Referring to the miners' strike, the Directors remarked that the Company were fortunate in obtaining the necessary supply of coal; and, with the exception of some slight delay, no inconvenience was felt until the storms of November prevented the deliveries being made in regular order—this involving the purchase of about 3000 tons outside the quantity of coal contracted for. Turning to the financial statements, it is seen that during the six months £103,742 was received from private consumers; £7109, from public lighting and under contracts; £3043, from meters; £12,941, from coke; £703, from breeze; £4618, from tar; £5272, from ammoniacal liquor and sulphate of ammonia; £205, from rents; and £43 by way of transfer fees—making a total of £137,680. On the opposite side of the account, the expenses incurred in the manufacture of gas are shown to have amounted to £77,997, of which £53,872 was spent on coal, cannel, and oil. Under the other headings, the figures were: Distribution of gas, £6562; lighting and repairing public lamps, £543; rents, rates, and taxes, £4586; management, £4768; law charges, £176; bad debts, £391; abatements and allowances, &c., £1992; annuity account, £500—making the total expenditure £97,517; and leaving, as previously mentioned, £40,163 profit on the half-year's trading. The working statements show that the amount of common coal carbonized was 56,330 tons; and of cannel, 9927 tons, "in addition to oil spirit." The quantity of gas made was 668,411,000 cubic feet; and the estimated yield of residuals was as follows: Coke, 81,286 chaldrons; breeze, 7675 chaldrons; tar, 782,366 gallons; and ammoniacal liquor, 1,194,043 gallons.

THE BOARD OF TRADE REPORT ON THE GAS, &c., BILLS AND ORDERS OF THE PRESENT SESSION.

The Board of Trade report on the applications for Gas, Electric Lighting, and Water Bills and Provisional Orders for the present session has been issued. It shows that the number of Bills relating to the supply of gas is 19, of which 15 are for England and 4 for Scotland. Seven of these Bills contain provisions in regard to the supply of water. The capital proposed to be raised is £1,374,200—£630,000 by shares, and £744,200 by loans. There are 22 Bills relating to the supply of water (one only being Scotch, and for this no capital is required)—one of them also providing for the construction of a railway. The total capital asked for is £3,822,490—£985,000 by shares, and £2,837,490 by loans. Provisional Orders to the number of 15 have been applied for in respect of gas and water, and 26 in regard to electric lighting schemes. The capital proposed to be raised under these Orders is: Gas, £192,500; water, £152,000; electric lighting, £402,970. Compared with last year, the number of Gas Bills has increased by four; that of Water Bills by one—the total for the two classes of Bills being now 41, against 36 last year and 43 in 1892. The capital required for gas purposes is £267,540 less, and that for water purposes £983,424 more, than last year. For Gas and Water Orders the capital proposed is £105,521 less, and for Electric Lighting Orders £353,380 less than in 1893. The applications for the last-named Orders show an increase of eight. But there is a considerable falling off as compared with the three preceeding years, when the numbers were: 1892, 32; 1891, 70; and 1890, 161. The report contains, as usual, an analysis of the Bills and Orders.

SOME NOTES FROM AMERICA.

From Our Own Correspondent.

Mr. C. D. Jenkins, who recently succeeded Major Hinman as Inspector of Gas and Meters for the State of Massachusetts, has issued his first report. Mr. Jenkins was for many years assistant to the former Inspector. Therefore, when the latter gentleman resigned his office to accept the position of General Manager to the Nathaniel Tufts Meter Company, of Boston, Mr. Jenkins was his natural successor; and he has carried on the work along the lines laid out by his predecessor. The report gives the number of meters tested during the year 1893 as 19,706, all of them being of the dry type. Of this number, 19,175 were either new or repaired; while 531 were inspected on complaint of the gas companies or the consumers. In testing meters, the report says, it is necessary to have the temperature of the air in the room, the air in the meter-prover, and the water in the tank, all alike; and when these conditions exist, and the meter is tested at the rate of 6 cubic feet per hour for each light, the meter is passed as correct. We are told in the report that "meters set in dry places, where the temperature is moderate and equable, need attention in perhaps only five or six years, and will generally remain accurate much longer; but if the places chosen are near or over furnaces or steam-boilers, or other unsuitable places, more frequent examination is necessary. The quality of the gas supplied through the meter has an important bearing also. A large percentage of ammonia or unfixed oily vapour may affect the registration by combining with the oil used to render the leather diaphragms soft and pliable, and also by corroding the moving metal parts. Sulphuretted hydrogen and tarry matter in the gas tend to make the meter work hard." Of the 531 meters reinspected, 3 would not register; 287, or 53 per cent., were correct; 197, or 37 per cent., were fast, the average error being 5·1 per cent.; and 46, or 8·7 per cent., were slow, the average error being 9·3 per cent. The average of those registering was 1·23 per cent. fast. With the exception of the year 1875, this is the highest percentage average of fast meters for 20 years. On the subject of gas inspection, the report summarizes the law in the statement that the gas supplied by a company having more than fifty customers shall be tested at least twice a year—an additional inspection being made for each 6 million cubic feet of gas supplied. The candle power, by a burner best adapted to the gas being tested, and passing at the rate of 5 cubic feet per hour, is to be equal to 16 English sperm candles. For coal gas, Sugg's "London" Argand D burner was used; for water gas, Sugg's open "table-top" 6-feet burner; and for the mixed coal and water gas, the Argand again. The first table of tests given by Mr. Jenkins is for the larger companies of the State, manufacturing more than 15 million cubic feet annually; the test being made at least a quarter of a mile from the works. In testing the gas of the 44 smaller companies, a portable photometer was made use of. With regard to this instrument, Mr. Jenkins says: "This useful piece of apparatus, weighing scarcely 65 lbs., contains everything necessary to determine the candle power of gas, packed in a small trunk; and the smaller companies may therefore be tested in any available place, such as a town hall or hotel." The result of 52 inspections of the Boston gas for candle power gave: Highest, 27·7 candles; lowest, 19·9 candles—average, 24·83 candles. The competitor of the Boston Company—the Brookline Company—had an average of 19·06 candles; the highest test being 24 candles, and the lowest 16·6 candles. Among the companies making both coal and water gas, that at Lawrence has the smallest variation in illuminating power. The highest of 14 tests was 21 candles; the lowest, 18·6 candles; and the average, 19·66 candles. The Haverhill Company make a mixed gas, varying from 20·9 to 27·6 candles—The lowest candle power of the so-called larger companies is noted against Cambridge; the average being 16·99 candles. The average of these companies is 19·41 candles. The average amount of sulphur is 8·84 grains per 100 cubic feet; while the figures for the smaller companies are 18·54 and 7·80 grains respectively. Four companies are noted as being below the standard in respect of illuminating power during the year; and seven are down on the sulphuretted hydrogen list. Speaking of the latter lists, Mr. Jenkins says: "At both of these places (Salem and Springfield), special efforts were made to properly purify the gas after attention was called to the trouble; but though made and put into the holders clean, the gas became foul from the water in the tanks and drips—unsuspected sources of contamination." Eight companies are down as having a quantity of ammonia beyond the legal standard—10 grains per 100 cubic feet. The following is an analysis of the Boston gas, made on April 24 last: Illuminating power, 26·6 candles; illuminants, 16·63 per cent. by volume; marsh gas, 19·24 do.; hydrogen, 31·71 do.; carbonic oxide, 26·84 do.; nitrogen, 2·45 do.; carbonic acid, 3·13 do. The gas at Jamaica Plain (a coal gas) was analyzed on May 1, with the following results: Illuminating power, 18·5 candles; illuminants, 6·39 per cent. by volume; marsh gas, 38·17 do.; hydrogen, 45·76 do.; carbonic oxide, 7·18 do.; nitrogen, 2·50 do. The report concludes as follows: "On June 27 the gas furnished by an experimental plant in Chelsea was examined. With a candle power of 11·7, the analysis showed: Illuminants, 16·03 per cent. by volume; marsh gas, 13·94 do.; ethane, 1·26 do.; carbonic oxide, 9·12 do.; nitrogen, 58·14 do.; carbonic acid, 1·51 do." The name of this gas is not given. But, in justice to the Chelsea Gas Company, it should be stated that this experiment is not being made at their works; it is one of the many will-o'-the-wisp affairs. The record of more than 16 per cent. of illuminants, 58 per cent. of nitrogen, and a candle power of 11·7, is a whole sermon against this kind of diluted gas.

The Philadelphia City Government still devote considerable time to lighting matters. If the worthy legislators thought their labours in this direction would be ended when they reduced the price of gas to $1 per 1000 cubic feet, they were evidently in error; for it seems to be the commencement of difficulties, not the ending of them. One problem now to be solved is how to manufacture the extra gas which will naturally be sold by reason of the reduction in price. The Engineer has reported that it will require $2,500,000 to put the property in shape to make the gas which will probably be called for; and the question is where to find this amount. Then some inquisitive people want to know how the deficiency which it is supposed will follow from this reduction is to be made good; and the answer is given that increased consumption will take care of this loss. That more gas will be sold at $1 than at $1·50, is certainly clear; but if it now costs the City $1 or more to make gas, it is not quite clear how the increased consumption will take care of this apparent deficit. Another feature worthy of note in connection with this subject is the number of patent processes being offered to the City—each being the one and only solution of the difficulty, and each vieing with the other in naming the prospective cost of gas by its own peculiar process. Then, again, all kinds of suggestions are being made as to leasing and buying the works. What the outcome of all the talk will be, is still an open question. Yet another interesting feature in connection with this matter has turned up lately. It comes from the fact that a small portion of the city is still supplied with gas by a private Company—known as the Northern Liberties. The price charged by them has generally been the same as that at which the Municipality sell gas in the city proper; but the Company have not felt justified in following this latest move, and have fixed the price at $1·25. This has naturally created a great deal of discontent in the Northern Liberties Company's section of the city; the people wanting to know why they cannot have gas at the same price as is charged in the city itself. The answer is made by the Press that the Northern Liberties, being a joint-stock Company, must earn a dividend of 6 per cent. on the capital employed; but that the City is not hampered in this way. The natural inference is that, in the case of the municipal plant, interest charges do not figure in the question of costs. Those who are of a nationalistic turn of mind, having secured dollar gas in Philadelphia, are directing their attention to the electric

light problem, and have petitioned the City to erect its own electric plant. One argument advanced in favour of the proposed plan is that, the City, not having to make any profit, could sell the electric light cheap; and so it would come into general use, and relieve the gas-works of the strain that will be put upon them next winter. It is stated that in 1883 the City commenced the use of electricity for street lighting by contracting for 49 arc lights; the annual appropriation for this object being $15,000. Now no less than 3427 arcs are employed; and the appropriation is $624,376. The Philadelphia Electrical Bureau has made an estimate that the City could erect plant capable of supplying 400 arcs for $100,000, and maintain the same at an annual cost of $36,672. This would equal an investment of $250 per lamp, and running expenses of $91 a year. Adding 10 per cent., which would be low on the cost, for interest and depreciation, we have $116 a year. Or it is estimated that the City could put in a plant of 2000 arcs for $636,000, with running expenses of $166,000 a year.

Quite an unnecessary and acrimonious discussion has been going on of late in San Francisco, in regard to the size of the gas-burners used in the street-lamps. It seems that the contract calls for 5-feet burners; and the claim is made that the tips have only three rings round them, and therefore can pass only 3 cubic feet of gas. A subsequent investigation by the City Inspector showed, however, that the burners actually passed the full quantity of gas.

The Committee of the House on the District of Columbia has recently been making some investigation to ascertain whether or not the inhabitants of the city of Washington were paying too much for gas. They find the average prices in cities having populations of 200,000 or more to be $1·22, against $1·20 in Washington. It is probable that this report will be satisfactory, and that no further action will be taken, though some parties are urging the erection of municipal gas-works.

The inhabitants of Springfield (Ill.) have recently been investigating the price of gas in their city, to see if they are paying too much. The report on the subject starts out with the statement that the Gas Company supply a mixture of coal and water gas, and that no exception can be taken to this process further than that the illuminating power is 18½ candles, which is also thought to be proper. On the matter of price, however, the investigation proceeded on rather novel grounds. The report states that the charge seems to be fair, if compared with the figures in other cities; but the fact that other cities are imposed upon in this direction is no argument in favour of Springfield also submitting to such injustice—or, rather, that is the way in which the report puts it. Then the document goes on to say: "The fuel making 30,000 cubic feet of gas costs $3·50, while it is sold to consumers at $1·50 per 1000 cubic feet, or $45. In other words, they convert $3·50 worth of fuel into $45 worth of gas. Does it seem possible the remaining $41·50 could be used up in labour, repairs, and interest on plant?" The report goes on to answer this question in the negative; and then to urge the erection of municipal gas-works. This seems to be the most novel investigation in connection with the price of gas which has lately come under my notice.

New Water-Works Loan for Bradford.—A special meeting of the Bradford Town Council was held last Thursday week for the purpose of considering and determining upon arrangements made on behalf of the Corporation by the Mayor and Chairman and Deputy-Chairman of the Finance and General Purposes Committee with the London and Westminster Bank and the Commissioners of Inland Revenue, for the creation and issue of debenture stock for £500,000 for water-works purposes, at 3 per cent. per annum, repayable at par in 1954.

Water-Works Extensions at Epsom.—Last Tuesday week, Major-General C. Phipps Carey held an inquiry at Epsom respecting an application by the Local Board for power to borrow £14,000 for works required to improve the water supply of the town. Speaking generally, the scheme proposed the erection of a large new reservoir, holding 600,000 gallons; the pumping of water to this from the existing works by a 15-inch rising main; and the utilization of the existing reservoir and the distribution of the water from that point. The application was opposed by the Grand Stand Association; and the Lord of the Manor objected to the site of the reservoir.

The Extensions at the Huddersfield Gas-Works.—In the minutes submitted by the Gas Committee at the last meeting of the Huddersfield County Council, it was stated that the Gas and Finance (Gas Expenditure) Sub-Committee had considered the subject of dealing with the extraordinary outlay incurred in the re-construction of the gas-works previous to the end of the financial year; and the Borough Accountant reported that the cost of the work amounted at the present time to £37,061. It was resolved that the sum of £9737—being the amount at which the depreciation fund stands—be appropriated in liquidating the expenditure, and that the balance of £27,324 be transferred to an open account, and liquidated yearly to such an extent as the Committees may decide, by appropriating for the purpose the whole or any portion of the yearly profits from the gas undertaking.

Wrexham Gas Company.—The annual meeting of the Wrexham Gas Company was held on the 21st ult. The report which was submitted stated that £1582 had been expended from capital upon extensions during the year. These additions were urgently needed, and consisted of new buildings, comprising enlarged retort-house and coal-shed, with a storeage capacity of 600 tons. A large sum had also been expended on new mains and service-pipes. The revenue account showed a decrease of £449 in the receipts from the sale of gas, as compared with the previous year. The loss sustained during the coal strike was very considerable; and the Directors would have been quite justified in raising the price of gas (which is 3s. per 1000 cubic feet), but they decided not to do so for the present. If, however, the profits continued to be insufficient to pay the ordinary dividends, it would, of course, be necessary to increase the price accordingly. The Directors recommended the payment of the usual dividends—viz., 5 per cent. upon the stock, and 3½ per cent. upon the shares for the half year; making 10 per cent. and 7 per cent. respectively for the twelve months. The report was adopted.

THE WATER SCHEME FOR DUBLIN OUT-TOWNSHIPS.

Local Government Board Inquiry.

An inquiry (which was continued over five days) has been held at Kingstown, by Mr. C. P. Cotton, C.E., Chief Engineering Inspector of the Local Government Board of Ireland, with Mr. Monahan, Q.C., as Assessor, with reference to the application of the Town Commissioners for a Provisional Order to invest them with power to promote the Lough Bray water scheme. The promoters were represented by Mr. John Gordon, Q.C., and Mr. T. M. Healy, M.P.; and the Dublin Corporation, by Mr. O'Shaughnessy, Q.C., and Mr. O'Connor. Several other authorities and individuals were also represented; and there were a large number of engineering and medical gentlemen present. At the outset, objection was taken to the *locus standi* of the Corporation on the one hand, and on the other Mr. O'Shaughnessy contended that the inquiry was an illegal one, and should not be held. However, after a good deal of argument, it was decided to proceed.

In laying the case for the promoters before the Inspector, Mr. Gordon first made it clear that at present only Kingstown and Dalkey were interested in the application. Briefly, he said, this was a petition presented by the Kingstown Commissioners as sanitary authority, in which they asked, among other things, that the Local Government Board should form a Joint Board of the Sanitary Authorities of Kingstown and Dalkey to work out the scheme. Since 1869, the Commissioners had obtained their water supply from the Dublin Corporation. When the Corporation Act of 1861 was passed, the area to be supplied with water was 12 square miles; and it was the Vartry water that was to be given to those who contracted with them. Since then the Corporation had gone on extending the supply of water to the extra-municipal districts until they had taken in 28 square miles, or nearly two and a half times the area their works were designed to supply. The result was they were absolutely unable to compete with anything like a dry season, and to supply the city and the townships that were depending on them. The Corporation were now proposing to procure and supply water (which the Commissioners did not contract to take) from Lough Dan, or somewhere else. The normal population of Kingstown was above 17,000; and they had a perfect right to have their own water-works, by which they would relieve the Corporation of the necessity of expending a very large sum of money—from £100,000 to £150,000—in obtaining an additional supply. The contract with the Corporation was that they should continue to supply not less than 20 gallons per head per day, unforeseen accidents excepted: but his clients could not regard the ordinary occurrences of Nature as "unforeseen accidents." From Oct. 10 till near the end of December last, Kingstown was left part of the time with one-fourth of their daily supply, part of the time with one-sixth, part of the time with one-half, and never with the whole of it. Dalkey had been in a similar position, and even worse, because it was on a higher altitude. His clients' scheme was to take the water from the Upper and Lower Loughs Bray. The altitude of the higher of the two was 1453 feet above the sea-level; and that of the lower lake, 1225 feet. These loughs formed natural reservoirs; and there would be very little trouble in making them into ordinary reservoirs. They were at an elevation which would enable water to be sent with great ease to the highest point in Dalkey, which was about 300 feet high; and they would be able to deliver the water there at a pressure of 472 feet. The only pressure they could get from the Corporation was 245 feet; but Kingstown never had that, and particularly during last year. The water would be carried in pipes to the reservoirs. It would be taken from the Glencullen River, and brought down to the reservoirs and filter-beds, and there would be a small supply reservoir at Kingstown; so that the whole of the scheme, so far as one could see, seemed simple and easy to carry out. They were satisfied that there was an ample supply for Kingstown and Dalkey, even if they took in Blackrock. Suppose they took the three townships, and gave them 30 gallons per head per day, that would amount to 1,050,000 gallons per diem; and it was 10 gallons a day more than what was contracted for with the Corporation. The area of the two loughs was about 93 acres; and they had a natural storeage of about 600,000,000 gallons. That was to say they were large enough to supply the townships for twelve months, without receiving an additional drop of water. There were no engineering difficulties; and the estimated cost of the scheme was £44,000, taking everything into account. If they left out Blackrock (as they would do, unless they wanted to come in), it would cost £40,000. They were paying 5d. in the pound now for a supply of water, which was not at all satisfactory, which was not at a sufficient pressure, and which had given rise to disputes and litigation. They could now have their own private supply for 4d. in the pound; and they would have it bought out in fifty or sixty years. The Corporation wanted to get 6d. in the pound from them for 30 gallons per head per day, which they could get by their own scheme for 4d. With regard to the opposition, the Bray Commissioners were quite mistaken. If there was any interference with them, they would get compensation; but they did not admit that in any way they would suffer. The owners of the land and others stood in a similar position; and their cases would be dealt with subsequently by arbitration, if the Commissioners succeeded in obtaining compulsory powers of purchase.

Evidence was then called. The first witness was the Town Clerk of Kingstown (Mr. J. Donnelly), who stated that, on the failure of the Vartry supply last year, the whole of the old wells and pumps of the township had to be opened; and in consequence, the Commissioners had to spend about £600. He also mentioned that the amount paid for water last year was £1347. The Engineer of the Commissioners (Mr. J. Berry) likewise gave evidence as to the supply during the past year; and afterwards Mr. W. G. Strype, the Engineer for the proposed works, was examined. He placed the entire cost of the scheme for the three townships at £39,000; and for Kingstown and Dalkey, at £35,000. He amplified the statements made by Mr. Gordon with regard to the works; and added that reports by Dr. Tichborne and Sir Charles Cameron as to the quality of the water were favourable. Mr. Baldwin Latham testified to the scheme being a good one; and he asserted that, if the Corporation had taken proper steps, they could

have prevented the failure of the supply last year. The examination of this witness concluded the case for the promoters.

In addressing the Court on behalf of the Corporation, Mr. O'Shaughnessy said they were still paying interest on £80,000 raised in connection with their water-works; and the supply to Kingstown was part and parcel of the security upon which the money was raised. People advanced their money on the security of the statutes bearing on the matter; and it was now suggested that these statutes should be repealed by Provisional Order, and Kingstown's portion of the security swept away. If it were, it would fall upon the ratepayers of Dublin. He submitted that the Corporation had not been in default in their contract with the Kingstown Commissioners. The Corporation had been continually in communication with the Commissioners with regard to the waste of water; and any shortness in the supply to Kingstown last year was largely due to the enormous and shameful waste, which the Commissioners took no care to prevent. The failure of the supply could not have been anticipated by any amount of human foresight. Concerning the cost of the proposed scheme, the estimate was far under the amount which the outlay would really reach; and its effect would be, if carried out, to raise the rates both in Dublin and Kingstown. He submitted that the Local Government Board had no power to make the Provisional Order sought for.

Counsel then called Mr. Spencer Harty, the City Engineer, who deposed that the storeage capacity of the Vartry system at Roundwood was 2438 million gallons; and the draught on it was about 12 million gallons per day. This gave 207 days' storeage. Lately they had added to the sources of supply by making a new reservoir at Stillorgan equal to double the capacity of the existing one. In addition to this, they had a supply from the eighth lock of the Grand Canal, and also the eighth lock of the Royal Canal; so that, for the supply of the city and extra municipal districts, they had 16 million gallons of water per day if necessary. Up to 1893 there had never been anything like a failure of the sources of supply; and previous to that year, he had not heard of any complaints from the Kingstown Commissioners as to an insufficiency of supply. From an engineering point of view, they had not enough information before them to judge of the proposed scheme; but his estimate of its cost would be £53,000, excluding all compensation for property. The Lough works would cost £2000; telephonic or telegraphic communication between the various parts of the works would mean an expense of about £100 a year; £14,000 would have to be added for the Corporation mains; and they would be entitled to about £3600 compensation for their special supply rights. This would bring up the cost to more than £70,000; and the annual expenditure would be £3181. There was an extra charge for maintenance; making the annual charge £4131. He did not think the scheme would be beneficial to the two townships. In cross-examination, witness admitted that he had verbally reported against the Corporation Lough Dan scheme; he being in favour of taking the full rainfall from the catchment area of the Vartry. This would make the Vartry deliver 7 million gallons of water more per day, at a cost of £80,000. Mr. Macassey had reported on the Lough Dan scheme; and his estimate was £65,000, as against his (witness's) £110,000. Mr. Macassey followed; and he stated that he did not think any man, no matter how far-seeing, could have anticipated such a period as last year. Leaving out 1893, the Vartry works had proved quite sufficient; but having regard to that year, he thought the Corporation should take precautionary measures to increase their supply. He agreed that the charges in connection with the Lough Bray scheme would run up to £70,000. In cross-examination, he said that, under his scheme, Kingstown would not always have Vartry water, as contracted for; and that his only objection to the Lough Bray scheme was the question of finance. The Right Hon. Alderman Meade, LL.D., and the Lord Mayor were also examined.

Counsel and witnesses were then heard on behalf of the Bray Commissioners, who considered they were bound in duty to oppose the scheme, having regard to the fact that they were satisfied that it would diminish to a very serious and material extent the flow of the River Bray as it entered the harbour, and in this way would seriously interfere with the maintenance of the harbour works. Other witnesses for individual opponents were also examined; and Counsel were afterwards heard in reply.

EAST LONDON WATER-WORKS COMPANY.

The Half-Yearly Report.

In the report of the Directors of this Company for the half year ending Dec. 25 last, which will be presented to the proprietors at their meeting next Thursday, they state that the revenue for this period was £157,587, as compared with £150,958 in the corresponding six months of 1892—showing an increase of £6629. The expenditure amounted to £63,038; being £51,599 for maintenance, and £11,439 for management. The total for the second half of 1892 was £56,818—being £47,007 for maintenance, and £9811 for management—or less by £6220 than that for the past six months. The Directors consider the increase of revenue to be satisfactory; and they point out that, although the addition to the expenditure is large, it has been chiefly caused by the outlay required to maintain the high character of the Company's supply. With regard to the works and plant, the new engine and boiler houses at Walthamstow are finished, and the engines and boilers partly erected. Similar houses at Lea Bridge are ready for the reception of the machinery now in course of construction for them. A contract for a quadruple expansion pumping-engine for the Chingford well has been entered into; and the work is well forward. Three new filter-beds have been commenced at Walthamstow; and it is expected that they will be completed and in full operation by Midsummer next. Some dissatisfaction has been expressed at the pressure of water in the high buildings at the East-end; and with the view of removing, as far as possible, any cause of complaint in this respect, a new 24-inch main, 4200 yards in length, was partly laid during the past half year; and it will probably be brought into use by the end of April. With respect to the extent of the supply, the quantity of water pumped in the period covered by the report was 7,716,195,531 gallons; while the business was increased by the addition of 2078 services—bringing up the total number to 176,506. The Directors recommend a dividend on the ordinary stock at the rate of 8 per cent. per annum, less income-tax. This will absorb £68,781 of the £82,828 available, and leave an unappropriated balance of £14,047. The balance applicable to dividend for the second half of 1892 was £83,449.

The Company's Charge for Water for Gardens.

The decision given by Mr. Lane, at the North London Police Court, on the question of the Company's right to charge for water used for gardens, reported in the JOURNAL last week (p. 574), has given rise to some newspaper correspondence. The defendant (Mr. J. J. Roberts) says he satisfied himself, before the case came on, that the Company were entitled to make an extra charge for closets, baths, and high service; but he disputed the additional charge of 10s. for the garden supply. "According to my own computation," he says, "a fair charge for this, having regard to the size of the garden and the quantity of water used, would have been 2s. I objected to pay the 10s., and contended that the Company had not complied with the provisions of their own Act, by making an agreement with the consumer as to the amount to be charged. The Company's Solicitor pleaded that I was estopped from raising this contention, by reason of my having already paid a quarter's rate, which included the charge of 10s. Now, the Company, in applying for the rate, had studiously neglected to specify the particular charges making up the total rate. When the Company in the same manner applied for the next half-year's rate, I applied for, and obtained, particulars of the specific charges, and afterwards objected to pay some of them, including the charge for the garden. Mr. Lane held that it was the duty of the Company to state their charges specifically when applying for payment; and as I had not agreed to the charge of 10s. for the garden, the amount was consequently disallowed. The decision amounts to this: No person within the jurisdiction of the East London Water Company need pay the Company's fancy charge for the garden. The Company's Secretary [Mr. I. A. Crookenden] has intimated that this state of things will be remedied, by which I gather that the Company intend for the future to do what has now been judicially decided they must do—viz., deliver specific particulars of their charges. My advice, therefore, to the consumers of the Company is this: Immediately the particulars are delivered, to send a written objection to the Company to the charge for the garden. It will be found in the majority of cases that the Company's fancy charge is exorbitant. The maximum charge the Company are entitled to make is 9d. per 1000 gallons." To this letter the Company's Solicitors (Messrs. Kebbell and Miller) have replied as follows: "The case which Mr. Roberts took into Court was not precisely such as he now represents it to have been. However, it did eventually develop into a question of whether the Company could, as he says, make the 'fancy' or 'exorbitant' charge of 10s. per annum for a garden supply by means of a hose. We do not know whether Mr. Roberts ever reflected that this 'fancy' or 'exorbitant' charge works out at a little over ¼d. a day. Probably not; but we can assure him that the Company would very much prefer not to give such a garden supply at twice the 'exorbitant' price of 10s. per annum. It is these garden supplies which use—or waste—the water just at the critical time when water is most precious, and which prevent the Company from keeping up pressure just when pressure is most necessary. Some people would water their gardens on the eve of a famine. It is beyond question that the Company can charge for a garden supply if it is required and given; and it is equally beyond question that the Company are not bound to give such a supply unless they agree to do so." Subsequently the Company's Solicitors sent another letter, in which they referred to Mr. Roberts's statement as to the Company's maximum rate being 9d. per 1000 gallons, and to his remark that, upon this basis, he should only be charged for his garden supply 1s. 10½d., on an estimated weekly consumption of 200 gallons during three—*i.e.*, summer—months. They point out that Mr. Roberts did not mention that the same section which fixes this rate also enacts "that the Company shall not be required to supply water in any less quantity than 25,000 gallons in any quarter of a year." "The effect of this is," they say, "that the Company could require Mr. Roberts to pay 18s. 9d. for his three summer months (whichever those may be); and yet he complains of paying 10s. for the entire year, which leaves him at liberty to select his three summer months—a not inconsiderable advantage in this uncertain climate."

THE GRAVITATION WATER SCHEME FOR CARLISLE.

Mr. Mansergh's Reports.

In recent numbers of the JOURNAL, references have been made to the projected new water-works for Carlisle; but we have only been able to give some information concerning the financial part of the scheme, and not as to its nature. This we are now in a position to do; the two reports prepared by Mr. James Mansergh on the subject having been issued to the members of the Town Council. The second report, it will be remembered, considerably modifies the scheme delineated in the previous one.

The first document is dated Jan. 31, 1893; and in it Mr. Mansergh states that he first directed his attention to the several gravitation schemes mentioned in a report drawn up by Mr. Hepworth in 1891. These were the Cairn, the Caldew, Overwater Tarn, and the Ellen. Mr. Mansergh came to the conclusion that the head of the Caldew was the best of the several sources named; and he visited Mosedale on the Caldew, a little to the north of Bowscale Tarn. The position most suitable for the dam required to impound the necessary quantity of water he found to be a narrow place in the valley, about 650 yards above the bridge carrying the road between Mosedale and Bowscale, where the bed of the river is at a height of 745 feet above Ordnance datum. At that point he proposes to construct a bank 61 feet above the ground level, the top water-level being 800 feet above Ordnance datum. This dam would back the water up the valley for a distance of 1400 yards. The whole of the enclosed lands that now exist on the

watershed area would be submerged, with the exception of about 6 acres at Skiddaw House, 4½ miles higher up the valley. The area of watershed above the bank of the river is 8100 acres; the geological formation being the clay slates of the lower Silurian formation. The rainfall on the area in 1889 was 40·72 inches; but a mean annual rainfall of 50 inches is estimated, of which 24 inches will be collectable by means of the proposed Mosedale reservoir, which will hold 650 million gallons. These 24 inches will equal 12 million gallons daily; and, according to parliamentary practice, from 3 to 4 million gallons would have to be delivered to the river for compensation water—leaving a balance of 8 or 9 million gallons for the supply of Carlisle. No such quantity is likely to be required for Carlisle. Therefore there would be no necessity to provide anything like the amount of storeage above named. By agreeing to limit what is taken for the supply of Carlisle to 2 or 2½ million gallons a day, a material modification of the usual compensation terms would, Mr. Mansergh thinks, be sanctioned. From the reservoir at Swineside (which has been abandoned in the later scheme, No. 3), he proposes to convey the water by a 16-inch iron pipe to Southernby—a distance of 7780 yards; the gradient being 1 in 222. Thence he would convey it by means of a 15-inch iron pipe to Bird's Hill (11,860 yards), the gradient being 1 in 148; and from Bird's Hill to Durdar (4170 yards) by a 14-inch iron pipe, with a gradient of 1 in 89. The top water-level at Southernby would be 650 feet above Ordnance datum; at Bird's Hill, 400 feet above Ordnance level; and at Durdar, 250 feet above Ordnance datum. At Durdar he proposes to construct a service reservoir to hold 6 million gallons; the filter-beds having a sand area of 6000 square yards. The draw-off from the filter-beds would be about 1069 feet higher than the draw-off level at Gallows Hill. The total distance from Swineside to Durdar is 13½ miles. From Durdar to Union Street (5000 yards), an 18-inch water-main is proposed, to supply 2,500,000 gallons of water daily, which is more than twice the quantity now used. "This," Mr. Mansergh remarks, "is manifestly an ample provision for the future, and it may be suggested that the execution of some of the works may be postponed;" but he adds that this would be the case only in respect of the filters. The cost of the works, allowing 15 per cent. for engineering, superintendence, and contingencies, is estimated at £210,000, to which Mr. Mansergh adds £3000 for certain mains in the city which really form no part of the scheme. Besides prospecting for a water supply from the mountains and submitting the project already described, Mr. Mansergh went into the question of improving and developing the present supply by pumping from the Eden; but it is not necessary to refer to his proposals here, as the Water Committee have abandoned all idea of spending money in this direction.

As mentioned in our issue for the 20th ult., the above estimate being so large, the Committee could not entertain it; and thinking Mr. Mansergh had been misled as to the quantity of water at Mosedale, they had it gauged every day for three months during last summer, under Mr. Hepworth's directions. It was found at the end of the drought that there were nearly 4 million gallons per day flowing; and the Committee consequently instructed Mr. Hepworth to forward his figures to Mr. Mansergh, to see whether he could not revise his report, more especially in respect of the estimated cost of the scheme. Investigations by Mr. Mansergh's son proved the correctness of Mr. Hepworth's figures; and the second report was then submitted. It opens by dealing, at considerable length, with the question of the rainfall, which Mr. Mansergh sums up by saying that it may be assumed that the watershed of the Caldew above Mosedale is of such a character as to insure an unusually high dry-weather discharge; and he is inclined to think that it will be safe to estimate that 2 million gallons a day may at all times be relied on. This would suffice for a population of 80,000 at 25 gallons per head per day—a number which Mr. Mansergh estimates will not be reached in Carlisle for nearly fifty years from the present time. This being so, he asks the Committee, "Are you prepared to go to Parliament with a Bill which will authorize you to take not more than 2 million gallons a day for supply; leaving the matter of compensation to be dealt with under the Water-Works Clauses Act, sections 6 and 12?" On the question of compensation, the Committee consulted Mr. Balfour Browne, Q.C., whose opinion was as follows: "I have no doubt, under the circumstances, that a Bill could be framed without any clause giving compensation in water. I would leave the question of compensation to be dealt with under sections 6 and 12 of the Water-Works Clauses Act, 1847, under which the claimant has to prove damage by reason of the promoter's works, and under which he is compensated for such damage in money. There are many Bills which are now Acts in which no compensation water is provided. Indeed, I would say that in Acts for water-works in places south of the Trent, compensation water is the exception. I do not, from what I heard in consultation, think that the interests on the stream are so important as to make their opposition a matter of importance. If they did oppose, in the last resort it might be possible to introduce a clause to the effect that the Corporation should cease to take water when the flow of the stream went below 4 million gallons. I know of such limitations having been introduced." Upon this opinion, Mr. Mansergh remarks that the limitations referred to in the last clause would have to be given in another form, as after the experience of last year, it is clear that the Committee could not bind themselves not to take water when the flow had fallen below 4 million gallons. This brought him to the point upon which his opinion was specially desired—viz., as to the possibility of reducing by £100,000 the estimate of the gravitation scheme given in his first report as £213,000. The only way in which this can be done, he says, is by cutting out the projected storeage reservoir at Mosedale, and substituting for it a low head weir and straining chamber, giving no compensation water, but paying in money all parties who can prove that their property has been injuriously affected by the diversion of the water. The works of such a scheme ought not to cost more than £90,000, but as against this saving of £123,000 will have to be set the money payments above referred to; and the amount of these Mr. Mansergh is not at present in a position to estimate.

A public meeting of the citizens was held on Thursday, to consider "the desirability or otherwise of doubling the public debt of the city" by the adoption of the gravitation scheme. The meeting was called by the Mayor, in reponse to a requisition signed by 98 ratepayers. The proceedings were somewhat protracted, and resulted in the passing of the following resolution: "That this meeting is of opinion that the present source of water supply affords every facility for satisfactorily meeting the requirements of this city, and hereby expresses its strong disapproval of the proposal now before the City Council to spend a sum of £90,000 and upwards upon a gravitation scheme as not only totally unnecessary, but imposing upon the Municipality a grave financial responsibility, which neither the time nor the circumstances justify." The Mayor was requested to present the resolution to the Council. Not much importance is attached to the proceedings by our local contemporaries.

JOHANNESBURG WATER-WORKS COMPANY, LIMITED.

An Informal Meeting of this Company was recently held, under the presidency of the Chairman (Mr. W. G. Soper, J.P.), for the purpose of hearing a statement as to the position of the Company from Mr. B. I. Barnato. In opening the proceedings, the Chairman explained that on the occasion of their previous meeting he alluded to the absence of Mr. Barnato and Sir James Sivewright. The former gentleman had now returned from Johannesburg, and was prepared to lay before the proprietors an accurate statement as to the position of the Company. Mr. Barnato then expressed the pleasure it afforded him to come before the proprietors, and give them an explanation of the affairs of the Company, particularly in view of the persistent manner in which they had been attacked in certain quarters. He was glad, in the first instance, to be able to tell them that the concern was in an absolutely safe position, and that there was not the slightest reason for any fear or alarm on the part of any of the shareholders. In order to show the steady progress which had been made by the Company, he pointed out that the profits in 1891 were £17,450, and in 1892 they were £21,000; while last year the revenue showed an increase of £9000. Though he, in common with the other Directors, regretted that they were unable to pay more than 6 per cent., he showed that it was impossible, for obvious reasons, that a higher dividend could have been declared. Coming to what seemed at one time a crucial point in their history—the floating of a rival scheme—he had no hesitation in saying now, what he had said at the time, that the whole affair was a bogey. He attached no importance—and he asked the proprietors to do likewise—to any rival scheme that might be floated; for the Johannesburg Water Company occupied an absolutely unassailable position. In addition to having an ample storeage of water, sufficient to meet the requirements of the whole of the town, they were engaged in constructing additional reservoirs with a view to being able to meet any possible contingency. Moreover, they had exclusive rights for supplying nearly, if not quite, the whole of the Johannesburg suburbs; and even if a new company were ever successfully started, it could only obtain the right to serve the few shops and warehouses in the city, which took very little or no water. The Company occupied, he assured them, an absolutely secure position, from which nobody could dislodge them. Their revenue was steadily increasing. It was a matter of satisfaction to him to be able to state that during the last six months—from July of last year—the revenue was £30,290, and the gross profits £19,080, or more than 50 per cent. more than the profits of the corresponding period of the previous year, which was equal, after paying the debenture interest, to close upon 15 per cent. on the capital. Since the formation of the Company £160,000 had been spent; but for this money they were able to show very valuable assets. In conclusion, he asked the proprietors to believe him when he said that it was not his intention to make a "bullish" speech. There was no necessity for booming their shares. Their intrinsic value and that of the property were quite sufficient to commend them to the investing public; while the extent of his confidence in the concern might be gathered from the fact that never in its history had he possessed so large a holding of shares as he did now. A vote of thanks was accorded to Mr. Barnato for his address.

Proposal to Light Concordia by Petroleum Gas.—According to the "Argentine Notes" in the *Financial News*, a proposition has been laid before the Municipality of Concordia for the illumination of that town by means of petroleum gas.

Armagh Gas Company.—At the recent annual meeting of this Company, the report of the Directors, which was noticed in the JOURNAL for the 20th ult., was unanimously adopted; and among the votes of thanks accorded was one to the Engineer and Manager (Mr. James Whimster), for his attention to the business of the Company during last year. It was pointed out that the Company were in the satisfactory position of being able to increase their dividend; and for this the shareholders were greatly indebted to Mr. Whimster.

Teignmouth Gas and Water Supply.—Last Thursday week, at a meeting of the Teignmouth Local Board, the Gas Committee reported that a considerable extension of the gas-works was necessary, in order to meet the growing wants of the town. It was accordingly decided to ask the Manager to go into the subject and report at a future meeting upon the works necessary to meet the probable requirements of the next twenty years, and the estimated cost of them. The Local Board are also considering the question of a better water supply. Four sources have been in contemplation; and further inquiries respecting two of these—Leighon and Wallabrook—are now being prosecuted by the Water Committee. An attempt was made on the above-named occasion to postpone the matter until after the Town Council elections next November; but it received little support. In the meantime, considerable attention is being paid to the leakage of water. On Feb. 22 this was found to amount to 48,000 gallons per hour, or equal to a consumption of 38·4 gallons per head. A number of cases in which water was running to waste were afterwards dealt with; and the leakage was reduced by the 16th ult. to 16,000 gallons per hour, since which date there has been a still further decline.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have received information from Mr. J. M'Gilchrist, of Dumbarton, that he has arranged for the Eleventh Annual Informal Meeting of Gas Managers being held at Glasgow on Wednesday, the 11th of April. This year a change has been made from the Victoria Hotel to the North British Station Hotel, where better accommodation will be had. Mr. Thomas Wilson, of Coatbridge, will preside; and upon his address the discussion will take place. There is abundance of material for Mr. Wilson to give an interesting address upon; and he may be expected to acquit himself well. Before the meeting is held, those who attend it will have an opportunity of visiting the Dawsholm works of the Glasgow Corporation, to see the new water-gas plant, the Arrol-Foulis retort charging and drawing machinery, and the coal-breaking machinery at work there. The same arrangements are made as last year, when the company visited the same works, and were shown the large gasholder then in course of construction. The outward journey is from Queen Street station at 1.17 p.m.; and the return journey, from Great Western Road station at 2.56 p.m. The Committee of the North British Association of Gas Managers will, as usual, hold their Spring Meeting on the forenoon of the day; and in the afternoon, they will attend the meeting. Everyone connected with the gas industry is made welcome to attend this interesting and unique gathering.

Mr. J. Fulton, Manager of the Renfrew Corporation Gas-Works, has intimated his resignation as from May 15 next.

It was reported to the Aberdeen Corporation Gas Committee on Wednesday, that the large new gasholder at Gallowhill, of a capacity of 1,092,000 cubic feet, had been completed. The total cost has been £12,800, which is at the rate of £11 14s. 6d. per 1000 cubic feet. The two previous holders which the Corporation erected cost £20 15s. 2d. per 1000 cubic feet capacity.

The Town Council of Portobello have carried into effect their resolution to experiment with the lighting of the streets of the burgh by incandescent gas-lamps. As yet the experiment is on a small scale, consisting only of two lamps fitted in one lantern. It is a pity the Corporation have not made it larger. The experiment is an interesting one; but results of much value—either as to lighting or consumption, or the still more important subject of the capacity of the lamps to stand the wear and tear of outdoor service—can scarcely be expected from one lamp. Still, however, a beginning has been made; and other burghs may follow the example of Portobello, and go further.

The Committee of Management of the Arbroath Gas Corporation last week considered the subject of oil-gas manufacture. A report by the Works Committee, which was submitted, stated that the Manager (Mr. R. S. Carlow) had brought under their notice the new process—the Peebles system—and had explained the method of working; informing them that any saving which might be effected would depend upon the price of the oil, which, at present, was about £2 per ton. The Sub-Committee were of opinion that the prospects of a material saving were somewhat uncertain; and they agreed to recommend that no action should be taken until it should be seen whether the process really turned out a success in the towns where it has been taken up. The Committee of Management adopted the recommendation. They will not have long to wait for information. Mr. Yuill, of Alloa, has prepared a report on his working of the process, which now extends to more than a year, and which, when it sees the light of day, should convince them. As Mr. Yuill may be announcing his results himself at an early date, I shall not anticipate him. In addition, the accounts of the Perth Gas Commission, and of a number of companies which have adopted the Peebles process, will soon be published; and I expect they will be a chorus of praise. At the same time, there is no harm in proceeding cautiously, as the Arbroath Corporation have decided to do. By the way, the Edinburgh Corporation seems to me to be exercising a little too much caution, for they have had the subject before a Committee for, if I remember rightly, somewhere about a year; and no report has come from them.

The Works Committee of the Dundee Gas Commission this week had under consideration the subject of oil gas. Some of the members, it was stated, had seen the Perth oil-gas plant at work; and they wished to know whether its introduction into the Dundee works would be likely to lead to a reduction in the price of gas. There was not unanimity in the Committee on the subject; some of the members not caring to expend about £6000 upon plant. A small Committee was accordingly appointed to consider the subject, and report.

The Stirling County Council this week considered what action they should take with reference to the two Gas Bills for Falkirk, which are at present before Parliament. The Corporation of Falkirk, it was stated, had agreed that, in the event of the landward portion of the area of supply being formed into a burgh, or the County Council acquiring powers for lighting the district, they would sell all their plant in the transferred area to the new authority, at a price to be fixed by arbitration. The Falkirk Gas Company, on the other hand, refused to give any such assurance. The County Council accordingly resolved to petition in favour of the Corporation Bill, and to oppose that of the Company. This decision rather complicates matters; and the Gas Company, if they are to succeed, had better try to come to terms with the County Council. I would not suggest their giving themselves away, as the Corporation have done; but that they might have, in the event of a new authority being formed, the first offer of the right to light the district.

The actions of which I wrote some time ago, in which the widows of two men who were killed by the falling in of the walls of a gasholder tank at the Inverness Corporation Gas-Works, recently came on for trial before Lord Adam and a jury in the First Division of the Court of Session. The gasholder had been removed, as well as the portion of the tank which was above ground; and the workmen were taking down and removing the part of the tank which was below the ground. The method of dealing with the tank was to crack a strip of it with hammers, and then to pull down the section which had been freed by cracking. In order to prevent the section falling while the men were at work, the top of it was held by a rope, the end of which was anchored in the ground behind. When the cracking was completed, the rope was brought round to the front, and was used to pull down the section into the interior of the tank. Only half of a section came away one time, and the workmen were proceeding to bring the remainder down when an adjoining section fell upon them; killing one of the men on the spot, and fatally injuring the other. For the pursuers, it was maintained that the method adopted for taking down the tank was defective. The defenders said the accident happened in consequence of the men omitting to obey the instructions they had received from the Manager not to go into the tank without having the rope secured, and that the deceased were to blame for it. After a number of witnesses had been examined for the pursuers, the actions were settled by the Corporation agreeing to pay each of the pursuers £100, and to contribute £50 towards their expenses. The sums sued for amounted to £3200; so that the Corporation have made a very favourable settlement. I think it worth informing your readers what one of the witnesses said, in order that they may see what is to be contended with in Courts of Law. This witness—a local man, with little or no knowledge of gas-works—said that the walls of the tank should have been shored up, instead of being held by a rope. He also stated that the weight of the material which fell in was about 30 tons, and that the breaking strain of the rope was only about 2 tons. Shoring up, it appears to me, would have been more dangerous than the rope method, because it would have been difficult to get out the shores. As for the weight of the material, the witness evidently forgot that this was downwards, and that the thrust inwards was by no means the same as the dead weight. The real question at issue was whether the work at which the men were engaged was usual in gas-works; and, of course, the cases having been settled extra-judicially, this point has not been decided.

This week the Stirling Town Council have taken up a new attitude towards the subject of electric lighting. A special meeting was held to consider as to the terms upon which they might allow the Caledonian Electric Supply Company to furnish the light. To individual members of the Council, the Company had offered to supply light to the public lamps at not more than 4d. per unit, and to private consumers at not more than 6d. per unit; the actual charge to be the average of that of the eight principal towns in Scotland, based on the cost of production. To the Council, however, their offer was that the price should be fixed by a sliding scale; 6d. per unit being taken as the initial and maximum figure, and falling by ¼d. per unit for every 15s. per cent. of dividend above 8 per cent. The Local Authority were also to have the option of purchasing the undertaking at the end of 14 years; but if the purchase were made at any time before the expiry of 42 years, the Local Authority were to pay for it as a going concern, and the price was to be not less than a sum which would make up a total cumulative dividend of 7 per cent. on the capital actually received from the shareholders. The Council unanimously declined to come to an agreement upon these terms; and they resolved to fight the Company before the Board of Trade. I am not surprised at their new resolution; the terms were too onerous. It almost provokes one to laughter to see an 8 per cent. dividend being put forward as the basis of reduction in price. According to all experience, and the expectation of all except rabid electric light people, an 8 per cent. dividend upon electric lighting is a thing not to be dreamt of; and the effect of the arrangement would have been that, whatever might be the charge in other towns, in Stirling it would always have been 6d. per unit. Then as to the purchase price of 7 per cent. on the capital, one is tempted to ask why this figure was adopted, and why it should not have been, to be fair to both sides, the average of the actual dividends paid for a series of years, but in no case to exceed 7 per cent. With such conditions, the Town Council might have agreed, seeing they do not care to undertake the work themselves; but they could scarcely be expected to bind themselves and their successors in the manner the Company suggested.

Good progress is being made with the tunnelling operations in connection with the work of augmenting the Glasgow water supply from Loch Katrine. The Blairuskin tunnel (1328 yards in length) was finished on Jan. 18; the Dom of Chon tunnel (1673 yards long) is expected to be completed about the middle of this month; the South Freuich tunnel (833 yards long) was finished on March 5; and the North Freuich tunnel is expected to be completed about the middle of June. In all of them, however, a good deal of lining with concrete will require to be done, which will take six months. Towards the north end of the Loch Chon section—which is the section nearest to Loch Katrine—some very hard rock has been encountered. When the first aqueduct was being constructed through this rock, the progress, by hand labour, was only at the rate of 3 yards per month. In the driving of the present tunnels, by the use of machinery worked by compressed air, and nitro-glycerine explosives, a rate of progress equal to 25 yards per month has been attained. When the Water Commissioners make their annual inspection of the works in the end of June, it is expected that the whole of the tunnels will be open for the passage of the Commissioners, if they care to go through them, which I do not suppose they will.

Gas Explosion in Paris.—Last Thursday afternoon, a serious gas explosion occurred just in front of the well-known church of St. Germain l'Auxerrois, in the Place du Louvre, Paris. In consequence of the recent Anarchist outrages, the event caused great consternation in the neighbourhood, and indeed throughout the city. According to the Paris Correspondent of *The Times*, the explosion was caused through the accidental fracture of a gas-main by the pickaxe of one of a gang of workmen engaged in repairing the pavement. So great was its force, that it is reported by another correspondent to have made a hole about 13 feet long, 10 feet wide, and 5 feet deep in the ground, shattered all the glass in the vicinity, and wrecked an omnibus office, a *châlet*, and a newspaper kiosk; while a number of the upper windows of the Louvre Museum, about 250 yards distant, were broken. Hardly had the people who chanced to be near the spot recovered from their shock when a second explosion took place. A space was soon cl eared by the police; and the prompt arrival of firemen and main layers, who poured water into the hole and stopped off the supply of gas, soon removed all cause for further alarm.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 31.

Sulphate of Ammonia.—The position is practically the same. Shipments continue on a satisfactory scale; and if some orders have been taken at lower prices for April delivery, it remains yet to be seen whether the sellers will reap a benefit from their ventures. From what was experienced during such an apparently idle month as that just closed, it does not at all follow that a depression will set in during April. There will be no stocks to weigh the market down; and the production, in consequence of the exceptional weather, shows already a serious falling off. The absence of stocks in consumers' hands must remain a favourable feature; and the non-appearance of American orders seems counterbalanced by large Colonial business. There are now sellers at £14 at the ports; but buyers are not disposed to pay this price. Not more than £13 17s. 6d. seems obtainable. Nitrate continues firm.

LONDON, *March* 31.

Tar Products.—Ninety per cent. benzol is now steady at 1s. 2d.; and 50's benzol is in excellent request at improving rates—as much as 1s. 5½d. being offered for forward delivery. Creosote and tar oils are rather a drug on makers' hands; stocks being very large, and difficult to sell. Carbolic acid is firm, at slightly better prices; while cresylic acid is somewhat weaker. Anthracene is strong; and consumers are now beginning to feel the pinch brought about by the restrictive operations of the Tar Products Sales Committee. Several important tar contracts have been let during the week, at prices ranging between 12s. 6d. and 17s. In the latter case the buyer had practically no carriage to pay. The general outlook for tar products is far from being satisfactory; and although pitch continues fairly strong, it is difficult to see how the price can be maintained, in face of the continued falling value of coal. Prices are: Pitch, 25s. to 27s. 6d. Benzols, 90's, 1s. 2d.; 50's, 1s. 5d. Creosote, 1¼d. Creosote salts, 25s. Solvent naphtha, 1s. 2d. Toluol, 1s. 6d. Cresol, 1s. 4d. Crude benzol naphtha, 30 per cent., 6¼d. Carbolic acid, 60's, 1s. 8d. Anthracene, 30 per cent., "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia.—After a very strong market which has lasted for some time, sulphate of ammonia is somewhat weaker, and lower prices are being quoted. To-day's value appears to be somewhere between £13 15s. and £14, less 3½ per cent.; and gas liquor is 11s. to 12s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The position as regards all descriptions of round coal is gradually becoming more and more unsatisfactory; and even the protracted stoppage of the pits for the holidays last week has had no appreciable effect in diminishing the excessive supplies upon the market. It is only in exceptional cases where anything of moment was filled up during the stoppage; and the report from most of the collieries after the holidays was that they resumed work with very few orders having come to hand. House-fire requirements have necessarily fallen off; and the better qualities of round coal are a greater drug than ever upon the market. Competition from other districts increases in keenness; and the coalowners connected with the Lancashire Sales Association have experienced the greatest difficulty in maintaining their prices—concessions in some outside markets having to be made to prevent business passing altogether out of their hands. So far, there is little or nothing doing in the way of placing contracts for forward deliveries in any description of round coal, either for general manufacturing requirements or gas-making purposes; and the disposition generally seems to be to hold back, in the expectation that figures are very likely to get down to something like last year's level. The tendency of prices is in a downward direction; and the leading Manchester colliery firms held a meeting on Friday, to consider whether any further action should be taken with regard to list rates, to place them in a better position for meeting outside competition. Only a temporary sort of arrangement was come to, by which, for the time being, delivered and wharf prices for house coals in Manchester were reduced 5d. per ton, to place them more on a level with prices ruling in Salford. Pit prices throughout Lancashire for all descriptions of round coal continue very irregular. Average quotations are about 12s. to 12s. 6d. for the best Wigan Arley; 11s. to 11s. 6d. for Pemberton four-feet and seconds Arley; 9s. 6d. to 10s. for common house coals; with other descriptions of round coal, for steam, forge, and gas-making purposes, ranging from 8s. up to 9s. per ton at the pit mouth. The shipping trade also remains in a very depressed condition; and common Lancashire steam coals are not quoted at more than 9s., and the best qualities 10s. per ton, delivered at the Garston Docks or the High Level, Liverpool. The present very limited output of slack, owing to the restricted inquiries for round coal, is necessarily causing a scarcity of engine fuel in the market; and some collieries are stocking largely, solely with the object of obtaining supplies of slack to meet the requirements of customers. The result is that in most cases prices are hardening; and with the commencement of the month they have been advanced 3d. to 6d. per ton. Common slack could not be bought under 5s. 3d. to 5s. 6d.; the better classes fetching 6s. to 7s., and burgy about 8s. per ton at the pit mouth.

Northern Coal Trade.—There is rather an improvement in the demand for some kinds of coal in the North; and every week the opening of ports that have been closed for the winter should improve the shipping trade. Best Northumbrian steam coals are quoted 10s. per ton f.o.b., though one or two sales slightly below that price are recorded. Second-class steam coal is about 9s. to 9s. 6d. per ton. Small steam are very firm; the lessened demand for best coal a week or so ago, and the reduced production in the holidays, having caused small coals to be rather scarce. Thus while 4s. 6d. per ton f.o.b. is the general price, there are some coalowners who ask, and have obtained, 4s. 9d. per ton. Gas coals are fairly steady, and some large contracts have been booked; so that the tendency is to adhere strictly to the range of prices fixed, which varies from 7s. 3d. to 7s. 9d. per ton f.o.b. It is believed that the contract for the supply of Rotterdam has this year all been allotted to collieries in Durham; and though the price cannot be very definitely given, as it depends on what is allowed for the freight, it is thought that, taking the freight on the basis of last year, it will be for coal from 7s. to 7s. 3d. per ton on the average. Manufacturing coal is in better demand just now. Coke is dull for export; but there is a better local consumption. The price may be quoted as from 13s. to 14s. per ton f.o.b. Gas coke shows no alteration in price this week; but as the production is less than it was, and will further decrease for three months, it is probable that the scarcity will rather stiffen the prices.

Scotch Coal Trade.—The trade is in much the same position, with prices in many cases a little easier. Ell is being sent in considerable quantities to Baltic and Mediterranean ports; but otherwise there is not much foreign demand. Steam coal is not in great request at home; and the demand for both splint and main is quiet. The miners in the West, not having been supported in their "four days a week" policy by their brethren in the other districts, have abandoned it in favour of a "five days" policy; and have proposed a conference of the Federation to be held a month hence, the decisions of which will bind all the districts, as they are all affiliated. Except in a few instances, the masters are not pressing upon their men by reductions of wages. The prices quoted are: Main, 7s.; ell, 8s. to 8s. 3d.; splint, 8s.; and steam, 9s. 3d. to 9s. 6d., f.o.b. Glasgow. The shipments for the week amounted to 140,737 tons—an increase upon the quantity in the preceding week of 5291 tons, but a decrease as compared with the same period of last year of 3655 tons. For the year to date, the total shipments have been 1,526,635 tons—an increase of 293,585 tons over the corresponding period of last year.

The Peebles Oil-Gas Process.—The Thurso Gas Company have decided to adopt the Peebles oil-gas process; and the order for the apparatus has been placed with Messrs. R. and J. Dempster, Limited, of Manchester.

Exhibitions of Gas Appliances.—Messrs. Fletcher, Russell, and Co., Limited, have lately held successful exhibitions of their gas cooking and heating appliances at Stockton-on-Tees and Rochdale, under the auspices of the Corporations; and at Newcastle-on-Tyne, in conjunction with the Gas Company.

The Miners' Strike and the Non-Delivery of Gas Coal.—At the West Riding Winter Assizes recently, the case of the Elland-cum Greetland Gas Company *v.* Milnes, Stansfeld, and Co. was down for hearing. It was a claim by the plaintiffs for £1500 damages for non-delivery of coal contracted to be sold by the defendants to them; the defendants excusing such non-delivery by reason of last year's strike The record, however, was withdrawn upon the terms that the defendants admitted liability for the breach of contract; the amount of damages being referred to a person agreed upon.

Penryn Gas Company, Limited.—The annual general meeting of this Company was held on the 28th ult., at the offices, No. 5, Great Winchester Street, E.C.—Mr. Archbell J. Nutt in the chair. The accounts presented showed a profit of £380; and, after deducting dividends at the rate of 5 per cent. per annum, there remained an available balance of £198. Out of this amount it was decided to place £150 to a reserve fund, and carry forward £48. It was reported that the two retiring Directors—Messrs. A. J. Nutt and W. M'Keand—were in arrears on their shares; and the proprietors resolved not to re-elect them. Messrs. A. Widdows and R. Fish were appointed Directors in the place of those retiring; and Mr. Ewen was re-elected Auditor. A vote of thanks to the Chairman for presiding terminated the proceedings.

Assaulting a Water-Works Inspector.—At the Cardiff Borough Police Court on the 16th ult., Edward Ashley was summoned, under the Cardiff Corporation bye-laws, for assaulting Frederick Budding, a Water Inspector, in the execution of his duty on March 6. The Deputy Town Clerk (Mr. F. C. Lloyd), who appeared for the prosecution, stated that the Water-Works Clauses Act provided that any inspector might visit any house in the district for the purpose of examining the water-fittings—a provision which was made quite as much in the interest of the water consumer as the supplier. On March 5 the inspector visited defendant's house, but was prevented by Ashley from seeing the stable at the back. The following day he returned; but defendant struck him violently about the head. The injury he received was very serious at the time; and the only atonement Ashley had offered was to make the miserable suggestion that the case should be hushed up for a sovereign. In defence, Mr. W. Blake pleaded that complainant had exceeded his duty, and created inconvenience by his unceremonious entrance into the house. This the inspector denied; and a fine of £5 and costs was imposed.

The Ambleside Local Board and the Gas and Water Company.—The Ambleside Local Board having decided to oppose the Bill of the local Gas and Water Company, and to apply for powers to purchase the undertaking, a public meeting of the ratepayers has lately been held to consider the subject. A resolution endorsing the action of the Board was submitted; and, in its support, it was stated that the authority were not opposing merely for the sake of opposition, but to prevent the Company getting any undue advantage over the ratepayers. In regard to the purchase, it was argued that, as the Company was not a statutory one, the Board desired to acquire their works on unstatutory terms, which, it was declared, would make a difference to the town of about £6000. One of the speakers was Mr. Jones, J.P., the Chairman of the Company, who said that he considered the first negotiations were unfortunate. They had offered their works at a price which they thought they were well worth, and which at last year's return would have paid 4 per cent., and on five years' takings 3¾ per cent. The Board only offered £14,000, which would have brought the town 6¼ per cent. with last year's income, and 6 per cent. taking the average of five years. The shareholders undertook the supply of gas and water when no one else would; and it did not seem fair for the Local Board to take advantage of them. The resolution was carried by 72 votes to 17; and Mr. Jones demanded a poll.

Changes of Address.—Dr. Samuel Rideal, F.I.C., F.C.S., Gas Examiner to the Lewisham District Board of Works, intimates a change of his laboratory address to No. 28, Victoria Street, Westminster, S.W.——The Deimel Light Company, Limited, have removed to "Deimel House," Hatton Garden, E.C.

Penny-in-the-Slot Meters at Carlisle.—The system of supplying gas to cottagers and small consumers in Carlisle by penny-in-the-slot meters has now been in existence for a little over three months; and the number of consumers who have taken advantage of it is upwards of 350. A charge of 1s. 6d. is made for fixing the meter; and its rent is calculated for in the price which the consumer pays for gas—viz., 1d. per 28 cubic feet.

The Enrichment and Price of Gas at Bradford.—At a meeting of the Gas and Electricity Supply Committee of the Bradford Corporation last Friday, the members discussed at length the question of conducting experiments in the use of oxy-oil gas as an illuminant. A proposal was made to carry out a trial of the gas upon lines similar to those adopted in St. Helens and Huddersfield. But the voting for and against the motion was equal; and it was decided to hold a special meeting to further consider the question. A discussion also took place as to the advisability of increasing the price of gas, with the view of recouping the Corporation for the enhanced cost of production during the coal strike. Eventually it was resolved to defer the matter to the special Committee meeting already mentioned; and in the meantime certain returns and figures will be prepared to assist the members in dealing with the subject.

The Plymouth Corporation and the Gas Company's Bill.—As notified in our "Parliamentary Intelligence," the Corporation of Plymouth have lodged a petition against the Bill by which the Plymouth Gas Company are seeking to raise more money. They affirm that the amount of new share capital applied for is excessive; and they ask that, if further borrowing powers are granted, the Company shall be required to offer the loan capital for sale by public auction. They object to the clause by which the Company purpose continuing 2s. 6d. per 1000 cubic feet as the standard price, although the Company propose to reduce the dividend from 5s. to 2s. 6d. per cent. in respect to each 1d. per 1000 cubic feet charged in excess or diminution of the standard. The Corporation also ask that the nominal illuminating power of the gas should be increased from 14 to at least 16 candles; and they object strongly to the proposal of the Company to o btain powers to supply electricity for lighting and other purposes.

Athens in Darkness.—According to the special correspondent of *The Times* in Athens, the city was in total darkness for two hours last Saturday evening. On Sunday he wired the following particulars as to the cause of the occurrence: "The French Gas Company which supplies the city has made repeated demands on the Municipality for arrears amounting to about 500,000 frs.; but the latter body, which is in financial difficulties, has failed to provide the money. Last week, apparently by an after-thought, the Municipality made a counter-claim on the Company for 600,000 frs. on the score of fines, forfeits, &c. The Company then delivered an *ultimatum* refusing to continue to light the city; and the threat was carried out last night. The weather being cloudy, the darkness was intense, except in two or three streets where the shops remained open. Some anxiety prevailed; but happily no disorders occurred. At half-past eight o'clock, an arrangement was arrived at through the mediation of the Minister of the Interior; and shortly afterwards the lamps were lighted."

Issue of Further Capital by the Hartlepool Gas and Water Company.—A special meeting of the Hartlepool Gas and Water Company was held on Thursday last, "for the purpose of determining on the propriety or otherwise of further exercising the Company's powers to borrow on mortgage or bond, and to what extent." Mr. W. H. Fisher, J.P., presided, and said the Directors had exhausted their powers of borrowing. At the present time the capital account was £340,170; and their borrowing powers, which were one-quarter of this amount, represented £83,542. Against this sum they had borrowed £72,000; but there was still remaining £11,542, which the Directors required for the extension and improvement of the property. He then moved the following resolution: "That the Directors be and are hereby empowered and authorized to borrow the sum of £11,500 on mortgage of the Company's works, unpaid calls and rents, or on the Company's bond, or both, at such time or times and subject to such special stipulations as to the repayment thereof, as to them may seem meet." In reply to an inquiry, the Chairman said that during the current year they would need about £3800; and this, with £5561 already spent, would make £9361 out of the £11,500. The motion was carried.

Torquay Gas Company.—The annual meeting of this Company took place on the 24th ult.—Mr. W. H. Kitson, J.P., occupying the chair. The report presented showed receipts to the amount of £24,953 for the past year; the expenditure being £17,874. From the balance—£7079—the Directors recommended the payment of full dividends. The Chairman, in moving the adoption of the report, said the receipts during the past year were rather less than in 1892—£24,953, against £25,487. At the same time, their expenditure was also less—being £17,875, against £18,769; and their profit was £7079, as compared with £6717. The shareholders might congratulate themselves on this, considering the year they had gone through, more particularly with reference to the coal strike. The whole of the share capital authorized by their Act of 1878 had been raised, except £7 5s. They still had borrowing powers to the extent of £7500. The capital account had only been increased £612; more than half of this amount being for gas cooking-stoves lent on hire. A saving of £1300 was effected by the favourable contract for coal. Alluding to the Bill the Company are promoting, he said the Directors had agreed, at the request of the Town Council, to reduce the maximum price of gas from 5s. 6d. to 5s. The Council also wished them to put in the Bill a permissive clause allowing for the gas-works to be sold to the town. Acting on the best advice, the Directors did not think this was a reasonable request; and consequently they had declined to accede to it. In conclusion, he complimented the officials of the Company, and especially the Manager (Mr. R. W. Beynon), on the progress of the undertaking. The motion was carried.

Sales of Shares.—On the 21st ult., Messrs. N. Easton and Son sold by auction, at Hull, 40 old £5 shares in the *York United Gas Company*, at £11 7s. 6d. each; and 10 original £10 shares in the *Whitby Gas Company* at £20 12s. 6d. each.—At a public sale at Brighouse last Wednesday, 50 £10 shares in the *Kildwick Gas Company* changed hands at £12 12s. 6d. apiece.

The Leamington Corporation and the Gas-Works.—Negotiations have recently been proceeding between a Sub-Committee of the Corporation and the Gas Company respecting the transfer of the property of the latter to the town. It is understood that the terms on which the Company are willing to sell their undertaking are 26 years' purchase of the maximum dividends. This is considered excessive by the Sub-Committee; and it is believed the projected purchase will fall through.

The Cost of Gas and Electric Light.—An application made to the Education Department by the Finchley School Board for their sanction to a project for lighting the schools by electricity has been unsuccessful, as the new system would, it was stated, have cost annually about £120 or £130, whereas gas only comes to £45. The electric light has been adopted in the Western Club, Glasgow; and, so far, it has cost something like £90 per month. The largest gas bill for one year is stated to have been about £400. These facts are recorded in the current number of the *Electrical Review*.

Extension of West's Retort-House Machinery at the Old Kent Road Gas-Works.—The South Metropolitan Gas Company have placed an order with West's Gas Improvement Company, Limited, for the supply of a complete set of stoking machinery—comprising coal breakers, elevators, conveyors, storeage hoppers, and charging and drawing machines—to be erected at their Old Kent Road works, in No. 7 retort-house, which is at present being remodelled. The charging and drawing machines are to be of the compressed-air type, similar in construction to those in operation in No. 9 retort-house, but suitable for working five tiers of retorts. These are not the first five-tier machines supplied by West's Gas Improvement Company to the South Metropolitan Company; they having furnished such machines for the East Greenwich works several years ago. This is the fifth order with which the latter Company have entrusted the above-named firm for stoking machinery at Old Kent Road and East Greenwich.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 606.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p.c	10	12½—13½	..	5 11 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 6
100,000	20	14 Dec.	8	Bahia, Limited	20	10—11	—½	14 10 10
200,000	5	15 Nov.	6½	Bombay, Limited	5	4¾—5¼	+¼	6 3 10
40,000	5	,,	6½	Do. New	4	3¾—4	..	6 10 0
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	165—170	+2	5 0 0
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	205—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Mar.	11¼	British	20	45—47*	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	15½—16½	..	5 3 0
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	6—7	+½	2 17 2
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	102—103	+½	5 16 7
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	255—260	..	4 16 2
165,000	,,	,,	9½	Do. New do.	100	193—197	..	4 16 5
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	128—133	..	3 7 9
800,000	Stck.	14 Dec.	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref	100	203—207	..	4 16 7
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	105—110	+3	4 10 11
486,090	10	31 Jan.	10	European, Limited	10	22—23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15½—16½	..	4 10 11
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	233—238	..	5 0 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	98—102	+1½	3 18 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	273—278	..	3 12 0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	175—180	+1½	3 17 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	270—275	..	3 12 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental	100	212—217	..	5 10 7
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	110—112	+1	4 9 3
541,920	20	15 Nov.	5	Monte Video, Limited	20	13—14	+½	7 2 10
150,000	5	30 Nov.	8	Oriental, Limited	5	6—6½	..	6 3 1
60,000	5	29 Mar.	7	Ottoman, Limited	5	3¾—4¼*	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	2—2½	..	8 0 0
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	103—109	..	5 10 1
500,000	100	1 Dec.	6	2nd Do.	100	97—102	..	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	8¾—9¼	..	5 5 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	313—318	..	4 17 6
1,350,000	,,	,,	12	Do. B do.	100	255—260	..	4 12 3
260,000	,,	,,	13	Do. C do.	100	260—265	+4	4 18 1
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	152—155	+2	3 4 6
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	272—277	..	3 12 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	218—223	..	3 11 9
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 Dec.	8½	Grand Junction	50	112—116	..	3 13 4
708,000	Stck.	28 Feb.	11½	Kent	100	288—293	..	3 18 6
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max.	100	248—253	..	3 15 1
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200—205	..	3 13 2
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132-135*	+3½	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	365—370	..	3 5 6
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	155—160	..	3 15 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—152	..	3 19 0
1,155,966	Stck.	14 Dec.	10	West Middlesex	100	265—270	..	3 14 1

*Ex div.

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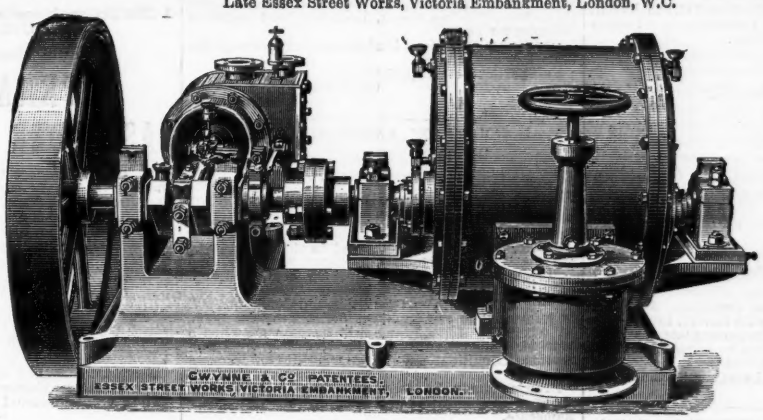

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Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

GAS AND CANNEL COAL.

GENTLEMAN having first-class connection among numerous Gas-Works in England and Continent desires Situation as TRAVELLER for either first-class Merchants or Colliery Proprietors. Good references.
Address No. 2363, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

IRISH BOG ORE OXIDE OF IRON.

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BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE LONDON."

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FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

DRAWINGS, Tracings, Specifications, Quantities, Strains, &c., prepared by an experienced Gas-Engineering Draughtsman. Plans of Works made, copied, or enlarged. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. H. OPPENHEIM, 27, FORE STREET, E.C.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

WANTED, a Gas-Meter Repairer, with experience as House Gas-Fitter.
Apply, by letter, stating age and wages required, and enclosing copies of not more than three testimonials, to No. 2364, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS MANAGER WANTED.

WANTED, by the Skibbereen Gas Company, a thoroughly COMPETENT MAN to take charge of their Gas-Works.
Applications, with copies of testimonials, to be sent to the SECRETARY, North Street, SKIBBEREEN.

AGENT WANTED.

ESTABLISHED Firm of Importers would appoint first-class AGENT having strong influence with London Gas Companies. The quality is the finest in the market. Liberal terms.
Address No. 2350, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CHIPPING NORTON GAS COMPANY.

WANTED, New or Second-hand, four PURIFIERS, 8 ft. to 9 ft. square, 3 ft. to 3 ft. 6 in. deep, or, if not square, of a like capacity. Also a Centre-Valve thereto (if on latest principle), or four Four-Way Valves, all 6-inch Connections preferred. The same, if not new, must be practically as good. Quotations (delivered here) are invited.

Also FOR SALE three PURIFIERS 7 ft. 6 in. by 6 ft. by 3 ft. 6 in. deep, with Centre-Valve thereto, all 6-inch Connections, in excellent condition.

Address THOS. BURTONSHAW, Manager.

TO BE SOLD—A Station Meter, in Good Working Condition, with Clock, Tell-Tale, Bye-Pass Valve, 6-inch Connections, and two Cup Valves.

Address the ELSECAR GAS COMPANY, BARNSLEY.

FOR SALE—A Two-lift Gasholder (Capacity 95,000 feet), with Cast-Iron Framing and Tank.

Address No. 2361, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Four Purifiers, 28 ft. by 14 ft., with Covers, 15-inch Centre-Valve, Connections, and Lifting Apparatus complete. Also Two PURIFIERS, 34½ ft. by 16 ft., with Covers, two 15-inch Four-Way Valves, and Connections, complete. Bargains to immediate purchasers. Must be removed in April for extensions. Can now be seen at work.

Apply to R. AND J. DEMPSTER, LIMITED, Newton Heath, MANCHESTER.

GRAVESEND & MILTON GASLIGHT COMPANY.

FOR SALE—A 10-inch Station Governor (Six Pillar Guides), with 12-inch Valves, Valve Columns, and Wheels, and the necessary Connections complete. In good condition. Taken out to make way for Governor of larger capacity.

May be seen on application to Mr. JOSEPH DAVIS, Engineer and Manager, Gas-Works, Canal Basin, GRAVESEND.

March 30, 1894.

THE Ballymena and Harryville Gaslight Company, Limited, invite TENDERS for 1700 tons of best Screened GAS COAL, free on Waggon at Larne Harbour, to be delivered before the 1st of November next.

Payment to be made on the first Thursday in March, 1895.

Tenders to be lodged with me on or before Tuesday, the 10th of April.

THOMAS C. C. HOOD,
Secretary

Ballymena, March 22, 1894.

THE Gas Committee of the Heywood Corporation invite TENDERS for the supply of about 450 yards each of 3-inch and 4-inch CAST-IRON PIPES and SPECIALS.

Specification and Form of Tender may be obtained upon application to W. Whatmough, Gas Manager.

Sealed tenders, endorsed "Iron Pipes," to be sent to me not later than Tuesday, April 17, 1894.

By order,
A. B. PILLING,
Town Clerk.

Municipal Buildings, Heywood,
March 30, 1894.

ROCHESTER, CHATHAM, AND STROOD GASLIGHT COMPANY.

RETORT-HOUSE FITTINGS.

THE Directors of the Rochester, Chat- ham, and Strood Gaslight Company are prepared to receive TENDERS for the supply of RETORT-HOUSE FITTINGS, particulars of which may be had on application at the Offices of the Company.

Tenders, endorsed "Retort-House Fittings," to be delivered not later than Noon of Thursday, April 19, 1894.

WILLIAM SYMS,
Secretary.

Gas Offices, Rochester,
March 31, 1894.

GASHOLDER TANK.

THE Directors of the Torquay Gas Company are prepared to receive TENDERS for the construction of a BRICK GASHOLDER TANK, 114 feet diameter and 26 feet deep, at their Works, Hollacombe, Paignton.

The Site, Drawings, and Specifications can be seen, and Form of Tender obtained, by application to the Engineer, Mr. R. Beynon, on payment of the sum of Two Guineas, which will be returned on receipt of a *bond-fide* tender.

Sealed tenders, endorsed "Tender for Gasholder Tank," must be sent to the undersigned, on or before Ten a.m., Monday, April 16 prox.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
JOHN KITSON,
Secretary.

Vaughan Parade, Torquay,
March 30, 1894.

Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Pro- perty Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

RAMSGATE CORPORATION.

(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for the surplus TAR (100,000 gallons, or thereabouts) to be made between the 1st of April, 1894, and the 31st of March, 1895.

Tenders to be returned on or before Saturday, April 14, addressed to the Chairman of the Gas and Water Committee, Hardres Street, Ramsgate, and endorsed "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

Full particulars on application to

WILLIAM A. VALON,
Engineer.

BOROUGH OF RAMSGATE FRONT IMPROVEMENTS.

CONTRACT No. 2.

THE Town Council invite Tenders for the erection of a HARBOUR MASTER'S HOUSE on a Site on the West Cliff.

Tenders to be sent in, addressed to the Chairman of the Front Improvements Committee, not later than Ten a.m., on Thursday, April 19 next, endorsed "Contract No. 2."

Copy of Specification, Quantities, and Conditions will be forwarded to any applicant desiring to have them, on receipt of £3 3s., which will be returned when a *bond-fide* tender is submitted, together with the Specifications, Conditions, and Bill of Quantities fully monied out.

Drawings may be seen and further particulars obtained on application to William A. Valon, Engineer, Ramsgate.

The Council do not bind themselves to accept the lowest or any tender.

By order,
W. A. HUBBARD,
Town Clerk.

Town Hall, Ramsgate,
March 30, 1894.

BOROUGH OF RAMSGATE FRONT IMPROVEMENTS.

CONTRACT No. 3.

THE Town Council invite Tenders for the erection of a CUSTOMS HOUSE in Lower Harbour Street.

Tenders to be sent in, addressed to the Chairman of the Front Improvements Committee, not later than Ten a.m., on Thursday, April 19 next, endorsed "Contract No. 3."

Copy of Specification, Quantities, and Conditions will be forwarded to any applicant desiring to have them, on receipt of £3 3s., which will be returned when a *bond-fide* tender is submitted, together with the Specifications, Conditions, and Bill of Quantities fully monied out.

Drawings may be seen and further particulars obtained on application to William A. Valon, Engineer, Ramsgate.

The Council do not bind themselves to accept the lowest or any tender.

By order,
W. A. HUBBARD,
Town Clerk.

Town Hall, Ramsgate,
March 30, 1894.

By Order of the Executors of Mrs. C. Black, deceased, and others.—Gas Stocks and Shares in the following Companies:—

South Metropolitan Gas Company.
Tottenham and Edmonton Gaslight and Coke Company.
Ascot District Gas Company.
Romford Gas and Coke Company.
Harrow District Gas Company.
Chelmsford Gas Company.
Brentwood Gas Company.
Woking Gas Company.
Uxbridge District Gas Company.

MR. ALFRED RICHARDS will Sell the above by AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, April 17, at One for Two o'clock precisely, in lots.

Particulars of J. JOBSON, Esq., Solicitor, 57, LINCOLN'S INN FIELDS, W.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C., and 816, High Road, TOTTENHAM.

NOW READY.

Second Edition, much Enlarged, with 94 Engravings, 8s. 6d.

Quantitative Chemical Analysis.

Adapted for the Laboratories of Colleges and Schools.

By Professor **FRANK CLOWES, D.Sc. Lond.,** and **J. BERNARD COLEMAN.**

London: J. & A. CHURCHILL, and all Booksellers.

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS,

By

NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

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WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

In Paper Cover, Price 1s.

GASHOLDERS
WITH OR WITHOUT
GUIDE-FRAMING.

A Discussion between E. LLOYD PEASE and F. SOUTHWELL CRIPPS.

To which is added a Synopsis of

LITERATURE ON GASHOLDER CONSTRUCTION,

Containing references to all the Literature (English and Foreign) on Reducing or Abolishing the Guide-Framing of Gasholders, also the principal Literature on Gasholder Construction generally, compiled to March, 1893; with a List of all the English and Foreign Periodicals connected with the Gas Industry.

COMPILED BY

F. SOUTHWELL CRIPPS,

Associate Member of the Institution of Civil Engineers Fellow of the Imperial Institute; Member of the Institution of Gas Engineers; Member of the Society of Arts

AUTHOR OF

"The Guide-Framing of Gasholders and Strains in Structures Connected with Gas-Works;"
"The Flow of Gases and Proportioning Gas-Mains," &c.

LONDON:
WALTER KING, 11, BOLT COURT, FLEET STREET, E.C

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

"CANNELINE"

FOR ENRICHING COAL GAS.

Superior to the very Volatile Hydrocarbons; requiring only a simple apparatus, at quite a nominal cost.

By this method, Coal Gas can be enriched by "CANNELINE" at a cost of ¾d. per Candle per ton of Coal, showing conclusively its vast superiority over all other Enriching Agents, including Cannel Coal.

For all particulars, apply to

S. BOWLEY & SON, Wellington Works, BATTERSEA BRIDGE, LONDON.

ARMSTRONG'S
PATENT
CANDLE SAFETY LAMPS.

Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,

(Established 1851,)

Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.
SCULCOATS, HULL.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from

C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

To effect a great saving in
GAS-FURNACES use our
Special Derbyshire **GANNISTER BRICKS.**
ADDRESS
JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE
BOGHEAD • CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·33 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]
TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	PER CENT.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

S. CARPENTER'S PATENT
HYDRAULIC MAIN CLEANER

ABSOLUTE SECURITY AGAINST ALL EXPLOSIONS. VERY GREAT SAVING OF LABOUR. NO INTERFERENCE WITH SEAL OF DIP-PIPES. PREVENTION OF STOPPED PIPES.

FOR FULL PARTICULARS OF WORKING AND ILLUSTRATIONS, APPLY TO

GIBBONS BROS., GAS ENGINEERS, DUDLEY.

THE AUTOMATIC GAS-METER CO., LTD.,

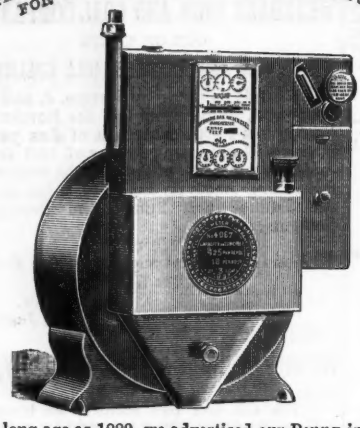
UPPER BROOK ST., MANCHESTER.

SOLE PROPRIETORS OF

THORP, MARSH, AND HAYNES' PATENTS.

PENNY-IN-THE-SLOT GAS-METERS.

THE AMOUNT OF GAS GIVEN IN EXCHANGE FOR COIN CAN BE ALTERED *IN SITU*.

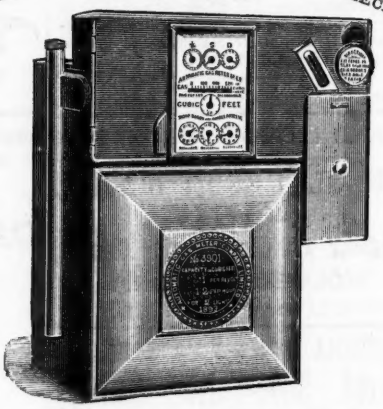


The persistent efforts of the Inventors of our Meters have been crowned with

SUCCESS.

There can be no two opinions on the question of the priority of our claim to the consideration of Gas Companies as *the First* Introducers, on a Practical Scale, of a Penny-in-the-Slot Meter.

THE AMOUNT OF CASH PLACED IN THE BOX IS RECORDED. THIS IS A COMPLETE CHECK AGAINST FRAUD.



PENNY-IN-THE-SLOT GAS-METERS.

So long ago as 1889, we advertised our Penny-in-the Slot Meters as having the now fully-recognized advantage of ability to alter **IN SITU.** Automatic Meters without Coin-Counting Index are liable to be tampered with.

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ALBERT BUILDINGS, 49, QUEEN VICTORIA ST., E.C.	UPPER BROOK STREET.	5, MERRION STREET.

THE WHESSOE FOUNDRY CO., LTD., DARLINGTON.

Established 1790.

MANUFACTURERS OF EVERY DESCRIPTION OF GAS PLANT,

FROM

RETORTS

TO

GASHOLDERS,

FOR WHICH THEY HAVE THE NEWEST AND MOST MODERN MACHINERY.

GASHOLDERS CAN BE MADE OF ANY DIAMETER AND PUT TOGETHER AT THE WORKS.

Holders having a capacity of 6,000,000 Cubic Feet have been made and erected; the largest one being 181 feet diameter by 136 feet 9 inches deep. Riveted entirely with $\frac{3}{8}$-inch diameter Hot Rivets.

SOLE MAKERS OF

THE WHESSOE PATENT CENTRE-VALVE

FOR WORKING PURIFIERS.

This Centre-Valve is the cheapest and most effective Valve in the market. Any unskilled workman can understand it; and it costs about half the price of any other Valve. The Purifiers can be worked in rotation or bye-passed singly, or bye-passed altogether; and the Valve can be worked either as a Hydraulic or Dry-Faced Valve.

AND SOLE MAKERS OF

COATES' IMPROVED PATENT FURNACE DOOR PROTECTOR

Which has been approved and adopted by the Gas Authorities at

SALFORD, MANCHESTER, BIRKENHEAD, STOCKTON, NEWCASTLE, DARLINGTON, &c.

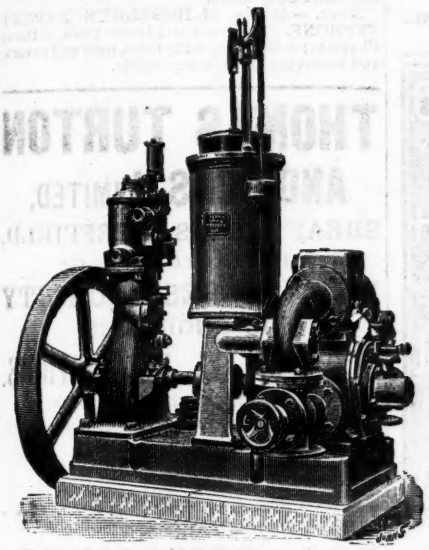
Telegraphic Addresses: "WHESSOE, DARLINGTON." "WHESSOE LONDON." | T. COATES, MANAGING DIRECTOR. | WORKS: DARLINGTON. LONDON OFFICE: 28, QUEEN STREET, E.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

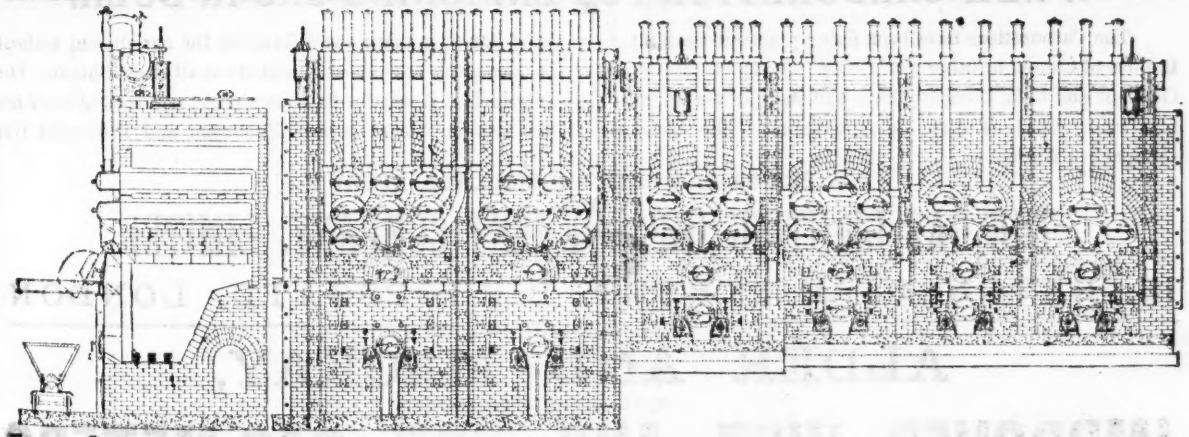
HUNTER'S
OXIDE OF IRON.
James Hunter, Lessee, Miner, and Shipper of
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "Hunter, Port Glasgow."
Established 1872.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, near DEWSBURY.



WALLER'S PATENT COMBINED GAS ENGINE AND EXHAUSTER
WITH
Disc-Valves, Automatic Bye-Pass Valve, Throttle-Valve, and Regulator,
COMPLETE ON ONE BASE PLATE.
Designed chiefly for sizes from 500 to 15,000 feet per hour.
CAN BE SEEN IN ACTION AT ADDRESS BELOW.
EXHAUSTERS OF ANY SIZE
COMBINED WITH GAS-ENGINES (now made to vary in speed).
ENGINES & EXHAUSTERS RUN AT DIFFERENT SPEEDS.
Waller's Washer-Scrubber with Wood Clusters.
ELEVATING AND CONVEYING MACHINERY FOR COAL, COKE, &c.
G. WALLER & CO.,
58, PARK STREET, SOUTHWARK (Surrey Side of Southwark Bridge).

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



These Settings are adapted to the requirements of all gas companies and gas corporations, and have already been very extensively adopted they are erected upon both the working-stage and shallow-chamber systems, and equally satisfactory results are guaranteed in both cases.
The Settings have attained to a measure of success and popularity quite unequalled by that of any other within the same space of time. The working results obtained, and the general satisfaction given, are declared in every case to exceed, and in most cases considerably exceed, the Patentee's guarantee. The construction and working of the patent producer and the patent charging apparatus for same are absolutely unique and unrivalled, and are the delight of every stoker; while in every other particular they secure the highest results attainable by any regenerative system, and at a minimum of cost.
Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.
Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* to the satisfactory working of the hydraulic main under the regenerative as well as other systems of retorts. Being largely adopted, and affording the highest satisfaction.

SPENT LIMES NO LONGER WASTE PRODUCTS
Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.
Descriptive Pamphlets and Terms from Agents as above.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

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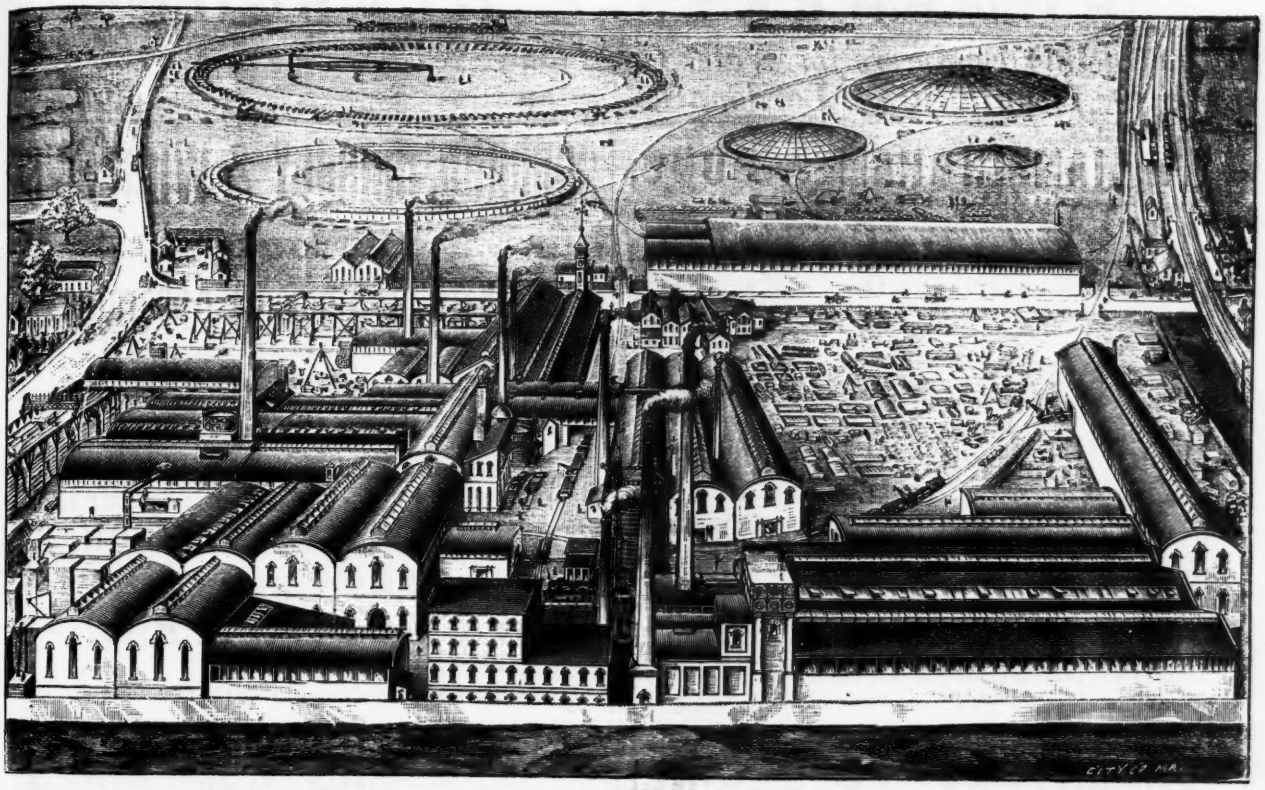

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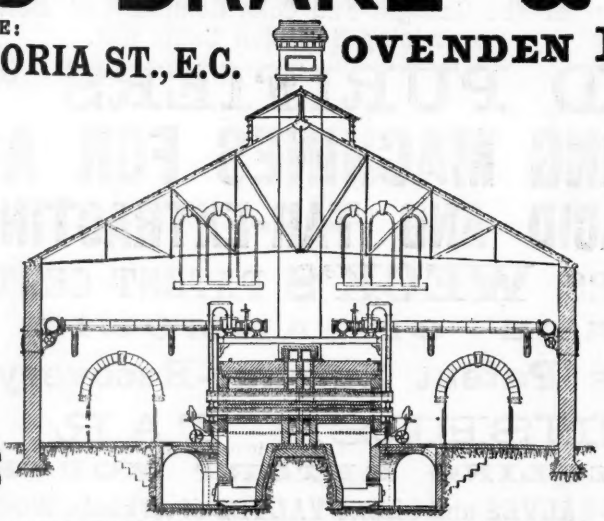

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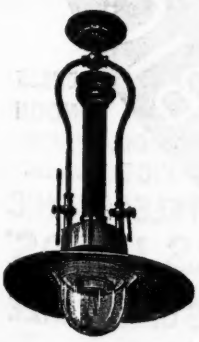

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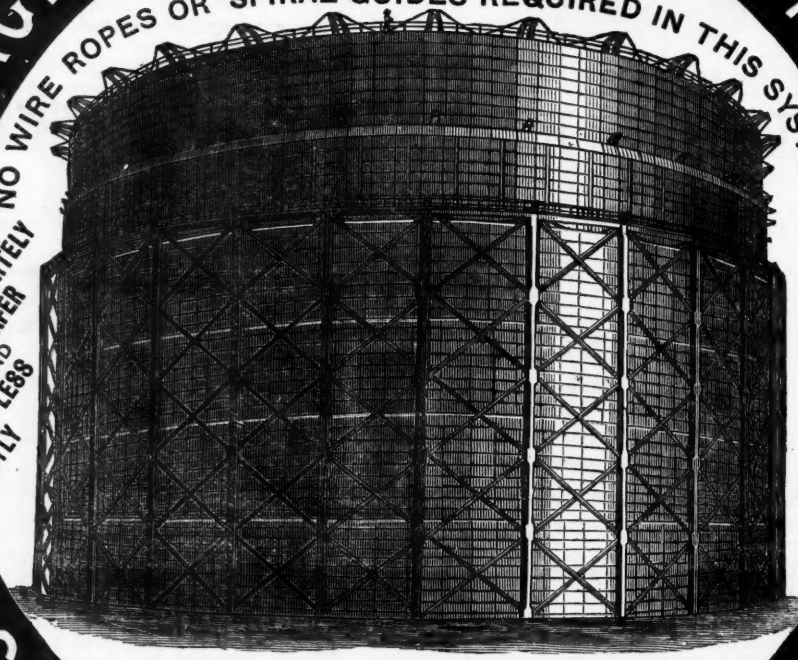

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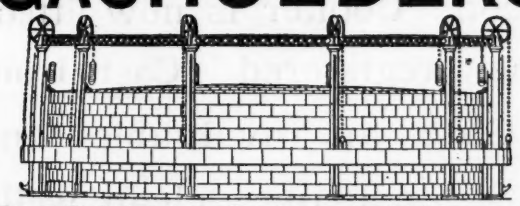

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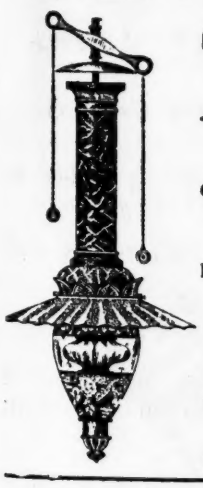

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[See also Advt. p. 602.

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